State of the art
Feline chronic gingivostomatitis

A closer look at...
‘COP’ based chemotherapy

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Welcome to the December edition of Feline Focus.

Dental disease is sadly common in our feline patients, and can be very painful, significantly affecting quality of life. The condition discussed in our first article by Rachel Perry, chronic gingivostomatitis, is no exception. Rachel goes through the treatment options to make affected cats more comfortable. Linda Ryan then covers a commonly used chemotherapeutic protocol, the ‘COP’ protocol, which is used in practice to treat lymphoma in cats. Not every case is suitable for chemotherapy, but more and more clients are electing to treat their pets, so nurses and technicians need to understand the drugs used, and potential side effects, as well as the health and safety implications. In the next article, I have covered the role of the owner in caring for a cat with chronic kidney disease. Unfortunately, there is not one single effective treatment for this condition, so involving the client in various aspects of their cat’s care is important. We finish with a case report by Laura Rosewell, on a cat with pyothorax. Nursing care is crucial for all cats, illustrated well here as chest drains can be painful, and the hospital environment stressful for a cat, with attention from nurses and technicians making a huge difference to recovery and the cat’s experience in the clinic.

Thanks everyone for listening to our webinars, don’t forget we have a ‘back catalogue’ for you to listen to so visit www.icatcare.org/nurses.

Happy Christmas!

Sam Taylor, Veterinary Editor

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Feline chronic gingivostomatitis: where are we now?

Feline chronic gingivostomatitis (FCGS) is a painful and debilitating condition seen not uncommonly in the feline patient. The exact cause still remains elusive and is poorly understood. Treatment can be very frustrating, with no guaranteed outcomes. It presents extreme challenges for the veterinary surgeon, registered veterinary nurse and client alike. The cat itself requires intensive nursing care with a comprehensive care plan including pain scoring, assisted feeding and grooming. Clear client communication is essential, as well as empathic counselling.

FCGS is characterised by its chronic nature and intense, often ulcerative and proliferative inflammation of both the gingiva (gingivitis) and oral mucosa (stomatitis). An accurate diagnosis by the veterinary surgeon is paramount. Intense gingivitis without signs of associated stomatitis is more likely to be a severe form of periodontal disease, requiring other treatment approaches potentially with a very different outcome. The prevalence is estimated to be between 1% and...
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5% of feline patients. With an estimated 7.4 million cats in the UK, this equates to 74,000–370,000 affected individuals.

Clinical signs
Cats that present with this condition are miserable. The disease is intensely painful due to the ulcerative component of the inflammation, and so they present with difficulty prehending and chewing food (dysprehension and dysmasesis) despite wanting to eat. Therefore, cats often lose weight due to hyporexia and have difficulty grooming so become unkempt. There is halitosis and ptyalism with copious, thick saliva and ‘dirty’, wet lip margins. Cats are often withdrawn, less active and may be irritable.

The oral inflammation typically affects certain areas of the mouth, and it is important to be specific with the terminology when describing affected areas. An understanding of feline oral anatomy is helpful in understanding the distribution of inflammation in disease (Figures 1 and 2). In fact, the characteristic distribution of inflammation can help in establishing a diagnosis. The disease is typified by caudal stomatitis, palatoglossitis, alveolar and buccal mucositis as well as gingivitis. Occasionally the tongue becomes ulcerated and may show loss of papillae (Figure 3).

The term ‘faucitis’ is often misused. The fauces are actually the lateral walls of the oropharynx, where the tonsils are situated. If this area is inflamed, then faucitis is the appropriate terminology. If the caudal oral area lateral to the palatoglossal folds is inflamed, then caudal stomatitis is the appropriate description (Figure 4).

Figure 1: Feline oral anatomy of the gingiva and mucosa. The gingiva is attached to both the tooth and underlying bone (blue arrows). This is confluent with the oral mucosa with the transition zone known as the mucogingival junction (red line). The mucosa overlying the jaw bones is known as alveolar mucosa (white arrows), which is continuous with the mucosa lining the cheeks or lips (buccal or labial mucosa [asterisk]).

Figure 2: Terminology of inflammation seen in cases of FCGS
Diagnosis
A tentative diagnosis may be reached by the veterinary surgeon after taking a thorough history and performing a conscious oral examination. An accurate diagnosis, however, is only reached after thorough examination under general anaesthesia. It is important to rule out other causes of ulceration or inflammation within the mouth, such as:

- azotaemia due to kidney disease;
- eosinophilic granuloma;
- squamous cell carcinoma; and
- periodontal disease.

Full mouth dental radiography is strongly encouraged, as most cases demonstrate moderate or severe periodontitis, which is often associated with inflammatory root resorption. In addition, over 50% of cats will have the presence of retained roots requiring treatment.\(^5\)

Biopsies should be obtained at this point if there is any doubt over the diagnosis, for instance if the inflammation is asymmetrical. Inflammation in FCGS is usually symmetrical.

Aetiology
The exact aetiology of this disease remains obscure, but the best working hypothesis is that the disease arises from an inappropriate immune response to oral antigenic stimulation. Various infectious agents have been implicated; however, attributing direct causation to these agents is difficult as they may be harboured in both healthy and diseased cats.

Viruses
Feline calicivirus (FCV)
FCV is known to cause acute upper respiratory tract disease, pyrexia, oral vesicular disease resulting in
ulceration and acute arthritis in cats, but vaccination does not stop cats from becoming infected.6,7 Following infection, the patient may either clear the virus or continue to shed the virus for >30 days (so-called carriers). Inoculation of the virus into specific pathogen-free cats resulted in the acute, respiratory form of the disease but did not cause chronic gingivostomatitis.7 The prevalence of FCV in the general cat population is high, but it has been shown that cats with FCGS are more likely to test positive for the virus.6,8 This association though does not imply causation of disease, and it may be that the virus is able to survive in the inflamed tissue, because the cat’s immune response is inappropriate.

Feline immunodeficiency virus (FIV) and feline leukaemia virus (FeLV)

In a recent cross-sectional survey of 5179 cats, it was demonstrated that there was an increased risk of cats with stomatitis testing positive for FIV, especially if <5 years of age.4 Cats were more at risk of being FeLV positive if they demonstrated any inflammatory oral condition (gingivitis, periodontitis or stomatitis).

Feline herpesvirus 1 (FHV)

In another, albeit much smaller study, it was found that 88% of 25 cats with FCGS were concurrently shedding both FCV and FHV.9 Other studies assessing serum antibody levels are difficult to interpret, given the widespread practice of vaccinating cats against both FHV and FCV.10

Bacteria

Bacteria are ubiquitous in the feline oral cavity, with many hundreds of species present in both healthy and diseased states in the form of a protective biofilm known as plaque.11,12 Certain species appear to be more prevalent in disease states,11 and it has been shown that cats suffering from FCGS have statistically significantly increased levels of serum antibodies towards certain Gram-negative anaerobes such as Bacteroides species.12

Immune response

The ultimate determining factor in whether or not FCGS occurs in the presence of infectious agents, is the type and severity of the immune response that is mounted by the cat. It has been shown that affected cats have higher expression of the cytokines interleukin (IL)-1β, IL-6, tumour necrosis factor (TNF)-α and interferon (IFN)-γ.13 Histopathological and immunohistochemical studies demonstrate a progressive, chronic inflammatory infiltrate of predominantly lymphocytes and mast cells.14,15

Treatment

Treatment of the disease is frustrating, and can be very expensive for the client. Many approaches have been explored, and as yet there is no treatment option guaranteed to improve the cat’s quality of life. From a nursing perspective, these patients require thorough and well-considered nursing care plans. Particular attention should be paid to pain scoring and analgesic requirements,
Surgical management
Surgical management is directed towards the extraction of some or all of the teeth in the cat's mouth, with the hypothesis being that this effectively removes stagnant plaque bacteria (plaque bacteria adhere to epithelial surfaces too, but of course these are constantly in a state of turnover and regeneration). Clinical remission has been reported to be from 28–60% with an estimated 6% of cats being completely refractory to extraction therapy. The cats showing substantial improvement in abnormal behaviours at the first postoperative check are more likely to achieve clinical resolution or significant improvement.

Extraction therapy should always be performed under the guidance of dental radiography. It is imperative that root remnants are not left in the cat’s mouth, as this appears to be a trigger for ongoing pain and inflammation. This is certainly anecdotally reported by this author and other dental specialists. In addition, it is recommended that extractions are performed using a surgical (or open) technique creating mucoperiosteal flaps which are sutured closed to allow primary intention wound healing. The veterinary nurse or technician and veterinary surgeon should carefully consider analgesic and anaesthetic plans, bearing in mind these patients have often been in a state of chronic pain for months, if not years, and will then have additional acute surgical pain.

The use of a balanced and pre-emptive analgesic protocol is strongly recommended, including the use of pure mu opioids and local nerve blocks. For instance, this author will often use a pre-medication of methadone, followed by a constant rate infusion of...
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fentanyl, local nerve blocks with bupivacaine, and postoperative analgesia with buprenorphine transmucosally or fentanyl transdermally and a non-steroidal anti-inflammatory drug.

Premolars and molars should be extracted. The canines and incisors should also be extracted if there is intense adjacent inflammation or the teeth are otherwise diseased (eg, periodontitis or resorption).

**Tip**

Pre-emptive and multimodal analgesia, for example, pre-medication with methadone, a continuous rate infusion of fentanyl, local nerve blocks and postoperative analgesia with buprenorphine and a non-steroidal anti-inflammatory drug, can be effective for cats treated surgically.

**Medical management**

Medical management is usually directed towards plaque control using antimicrobials and immunomodulation or immunosuppression. Adequate analgesia should be a priority for these patients. Antibiotic therapy is warranted, and the choice of drug should consider both the likely bacterial species involved, and the ease of dosing the patient. Liquid formulations given in food (if the patient is eating) are preferable to trying to physically get a tablet into a painful mouth. Be aware that the forceful, wide opening of these patients’ mouths is exquisitely uncomfortable, and will often result in the cat crying out in pain. If the mouth needs to be opened (for example, to assess the amount of intraoral inflammation), open the mouth gently and slowly, and only as much as needed. Use one hand over the top of the cat’s head, holding the zygomatic arches, and rest the index finger of the opposite hand on the mandibular incisors. Do not pull on the fur of the lip.

The immunosuppressive drug ciclosporin is thought to work by the suppression of T lymphocytes. In a study of nine edentulous cats refractory to extraction therapy comparing this drug to a placebo, 45% achieved clinical remission. This is available in the UK and is licensed for use in cats for the treatment of chronic allergic dermatitis.

Recombinant feline interferon omega is an immunomodulatory drug licensed for the treatment of FeLV and FIV in the cat. Its use in FCGS patients refractory to extraction therapy has been explored, which showed a non-statistically significant improvement in clinical signs compared with prednisolone. Bovine lactoferrin appears to have antimicrobial, anti-inflammatory, immunomodulatory and anticarcinogenic properties and is available as an oral spray in some parts of Asia and Europe. In a study using it with piroxicam vs piroxicam alone as a control, 77% of cases appeared to show significant improvement over a 12 week period. However the randomisation process was not specifically stated (and may therefore have been biased) and the control group became the treatment group after week 4. Pilot studies exploring the use of autologous or allogeneic adipose-derived mesenchymal stem cells in a small number of cats shows encouraging results. However,
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Given the complexity of the acquisition, production and transfusion of stem cells, the treatment is not likely to be available to general practitioners for the foreseeable future.

Dietary change has also been investigated, as it is postulated that some unknown dietary antigen may be fuelling the oral inflammation. As yet, no study has confirmed a direct link between diet and the disease, nor shown a definitive benefit to dietary change.²⁴,²⁵

Lastly, the strong immunosuppressive effects of corticosteroids are well known as well as the potential for adverse effects. This author reserves their use for severe cases where extraction therapy has failed to improve the clinical situation if the client cannot afford other treatments (such as ciclosporin or interferon omega), where the only other option is euthanasia. Some patients do require euthanasia on humane grounds if the quality of life cannot be improved satisfactorily by surgical and/or medical means.

Summary

- FCGS causes intense pain and poor quality of life in a significant number of feline patients.
- The aetiology of FCGS is complex and poorly understood.
- An aberrant immune response to plaque bacteria and certain viruses is likely to be responsible for FCGS.
- Calicivirus is often detected with FCGS but does not cause the disease.
- Treatment of FCGS should be directed towards adequate analgesia, antibiosis and ultimately, surgical extraction of, at least, premolars and molars.
- Dental radiography is mandatory to ensure complete tooth removal.
- Referral to a dental specialist should be considered.
- Signs of improvement can take months to become apparent. These cats do not improve overnight.

Nursing implications

- Handle cats with FCGS carefully and gently, particularly around the head.
- When hospitalising patients with FCGS, provide a quiet, calm environment. It is unlikely that additional stress will improve the course of the disease!
- Levels of chronic pain are likely to be high with FCGS, such that affected cats may be experiencing the phenomenon of wind-up.
- Pay particular attention to pain-scoring using a recognised and validated scale, such as the Glasgow Composite Measure Pain Scale-Feline.²⁶
- Ensure affected cats are groomed daily.
- Ensure the facial area and lips are kept clean of saliva — this is often much thicker than normal, and very tenacious.
- Monitor body weight as cats with FCGS readily lose weight due to inadequate food intake.
- Experiment with foods of different consistencies to see which is best accepted.
- Consider assisted feeding via oesophagostomy tube placement if required.
- When planning surgical management, pay particular attention to an adequate analgesic plan using a combination of mu opioids and non-steroidal anti-inflammatory drugs.
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References
Lymphoma is a common type of cancer diagnosed in cats. Increasingly, cats with lymphoma are treated with chemotherapy, commonly the ‘COP’ protocol, including the drugs cyclophosphamide, vincristine and prednisolone. All drugs have potential side effects including bone marrow suppression and gastrointestinal upset, but these should be minimal on chemotherapy and quality of life maintained. Staff and client health and safety should be a priority when handling chemotherapy drugs and treated cats, and ensuring a low stress clinic environment is vital for the regular treatments required.

Cancer is a common cause of death in older cats. Despite this, there are a number of treatments available that can offer cats a good quality of life, meaning that a greater numbers of cats with cancer are being managed medium- to long-term. Chemotherapy is increasingly used in veterinary medicine as treatment for a range of cancers, and as an adjunct to surgery or radiotherapy for various neoplastic conditions.1,2

Chemotherapy is a systemic treatment most commonly used to treat diffuse cancers, such as lymphoma and leukaemia. For the treatment of lymphoma, multi-agent chemotherapy called the ‘COP’ protocol is used to control systemic disease and offer cats optimum quality of life for as long as possible.1–4

Key point
‘COP’ chemotherapy protocols are used for the treatment of lymphoma in cats and includes the drugs cyclophosphamide, vincristine and prednisolone used on a rotating basis.
A closer look at...

‘COP’ stands for the various chemotherapy agents used in the protocol, including cyclophosphamide, vincristine (brand name Oncovin) and prednisolone, which are used on a rotating basis to treat lymphoma (Figure 1). Lymphoma (or lymphosarcoma) is a malignant round cell tumour arising from lymphocytes. COP-based protocols are used to treat lymphoma, either as a stand-alone protocol, or in conjunction with other treatment modalities.1–3,5,6

Basic concepts of chemotherapy

The goal of chemotherapy is to inhibit the growth/kill cancer cells with minimum effect on normal cells. Most chemotherapeutic agents either bind directly to genetic material in the cell nucleus or affect a cell’s ability to synthesise protein. Treatment dose and schedule depends on the type of cancer. In high- and low-dose COP, periodic chemotherapy will be necessary to control the cancer for the rest of the cat’s life.1–3,6

COP combines cytotoxic drugs designed to target different parts of the cell cycle to increase the proportion of total tumour cells that are killed at any one treatment time. When drugs are used in combination, they often enhance the activities of each other in both a synergistic and/or additive way. Drugs are also combined to minimise their dose-limiting toxicities and help reduce the development of tumour resistance (cells resistant to one drug may be sensitive to another within that regimen). Single-agent therapy is less effective for lymphoma (it is used for the treatment of other cancers), but can be used for palliation. For instance, corticosteroids are an option for owners who are not keen to pursue chemotherapy, and many cats will achieve clinical remission for 2–3 months.1–3,6–8

Key point

Many cat owners will have a negative experience of chemotherapy in humans, and assume that cats will suffer hair loss and other side effects. It is important to explain that doses used are much lower, and side effects are minimal to absent.

Cytotoxic treatment of tumours relies on triggering programmed cell death (apoptosis). Treatment of lymphoma is aimed at exploiting this to kill a susceptible cell population. However, cancer cells are genetically unstable and undergo mutations at each replication, allowing for drug resistance. Cells which were originally susceptible to chemotherapy drugs develop resistance by multi-drug resistance (MDR). MDR is thought to be the reason for treatment failure in all canine lymphoma patients — when this occurs the patient will relapse. At the time of relapse, owners may be offered so-called ‘rescue’ chemotherapy protocols of novel drugs to attempt to achieve remission.1–2,6–8

Lymphoma is a highly chemo-sensitive tumour type, therefore cytotoxic drug therapy is the optimal treatment. Chemotherapy can induce a rapid response/remission and improve patient quality of life. Treatment in humans offers significantly higher cure rates than veterinary medicine, largely due to high-dose chemotherapy which, while optimal...
Table 1: Feline cyclophosphamide-vincristine (Oncovin)-prednisolone (COP) low-dose and high-dose chemotherapy protocols$^3,10$

<table>
<thead>
<tr>
<th><strong>High dose</strong></th>
<th><strong>Induction:</strong></th>
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<tbody>
<tr>
<td></td>
<td>• <strong>cyclophosphamide:</strong> 200–250 mg/m² PO or IV q21 days</td>
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<tr>
<td></td>
<td>• <strong>vincristine:</strong> 0.5–0.7 mg/m² IV q7 days for 4 weeks, then q21 days, concurrent with cyclophosphamide</td>
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<tr>
<td></td>
<td>• <strong>prednisolone:</strong> 1 mg/kg PO q24h for 4 weeks, then q48h</td>
</tr>
<tr>
<td><strong>Maintenance beyond 6 months:</strong></td>
<td>• <strong>cyclophosphamide:</strong> 200–250 mg/m² PO or IV q28 days</td>
</tr>
<tr>
<td></td>
<td>• <strong>vincristine:</strong> 0.5–0.7 mg/m² IV q28 days, concurrent with cyclophosphamide</td>
</tr>
<tr>
<td></td>
<td>• <strong>prednisolone:</strong> 1 mg/kg PO q48h</td>
</tr>
<tr>
<td><strong>Maintenance beyond 12 months:</strong></td>
<td>• <strong>cyclophosphamide:</strong> 200–250 mg/m² PO or IV q28 days</td>
</tr>
<tr>
<td></td>
<td>• <strong>vincristine:</strong> 0.5–0.7 mg/m² IV q5 weeks</td>
</tr>
<tr>
<td></td>
<td>• <strong>prednisolone:</strong> 1 mg/kg PO q48h</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Low dose</strong></th>
<th><strong>Induction:</strong></th>
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<tbody>
<tr>
<td></td>
<td>• <strong>cyclophosphamide:</strong> 50 mg/m² PO q48h or 50 mg/m² PO on the first 4 days of each week</td>
</tr>
<tr>
<td></td>
<td>• <strong>vincristine:</strong> 0.5 mg/m² IV q7 days</td>
</tr>
<tr>
<td></td>
<td>• <strong>prednisolone:</strong> 40 mg/m² PO q24h for the first week, then 20 mg/m² PO q48h, concurrent with cyclophosphamide</td>
</tr>
<tr>
<td><strong>Maintenance beyond 2 months:</strong></td>
<td>• <strong>cyclophosphamide:</strong> 50 mg/m² PO q48h or 50 mg/m² PO on the first 4 days of every second week</td>
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<tr>
<td></td>
<td>• <strong>vincristine:</strong> 0.5–0.7 mg/m² IV q14 days</td>
</tr>
<tr>
<td></td>
<td>• <strong>prednisolone:</strong> 20 mg/m² PO q48h on every second week, concurrent with cyclophosphamide</td>
</tr>
<tr>
<td><strong>Maintenance beyond 6 months (if patient is in remission):</strong></td>
<td>• <strong>cyclophosphamide:</strong> 50 mg/m² PO q48h (1 week in 4) or 50 mg/m² PO on the first 4 days of every third week</td>
</tr>
<tr>
<td></td>
<td>• <strong>vincristine:</strong> 0.5–0.7 mg/m² IV q28 days</td>
</tr>
<tr>
<td></td>
<td>• <strong>prednisolone:</strong> 20 mg/m² PO q48h on every fourth week, concurrent with cyclophosphamide</td>
</tr>
<tr>
<td><strong>Maintenance beyond 12 months:</strong></td>
<td>• <strong>cyclophosphamide:</strong> 50 mg/m² PO q48h (1 week in 4) or 50 mg/m² PO on the first 4 days of fourth week</td>
</tr>
<tr>
<td></td>
<td>• <strong>vincristine:</strong> 0.5–0.7 mg/m² IV q28 days</td>
</tr>
<tr>
<td></td>
<td>• <strong>prednisolone:</strong> 20 mg/m² PO q48h on every fourth week, concurrent with cyclophosphamide</td>
</tr>
</tbody>
</table>

IV = intravenous; PO = by mouth

Note: Perform a haematology and urinalysis before initial therapy and every 4 weeks thereafter
A closer look at...

for tumour treatment, risks high patient-toxicity rates too. Because of the potentially severe, debilitating side effects seen in human chemotherapy patients, many cat owners have a negative perception of chemotherapy in pets, assuming similar adverse effects in cats. This, as well as the emotional nature of a cancer diagnosis, means that many owners’ first reaction to chemotherapy is: ‘I don’t want to put my cat through that’. However, in veterinary oncology, quality of life is paramount and chemotherapy protocols use much lower doses (often less than one third) those used in human medicine, with reduced intensity, resulting in many fewer, and less severe, adverse effects. The payback for good quality of life is often limited life-expectancy.1–2,7–9

COP-based chemotherapy protocols
Three cytotoxic drugs make up the COP protocol: cyclophosphamide vincristine (Oncovin)-prednisolone.

Cyclophosphamide
Cyclophosphamide is an alkylating agent, nitrogen mustard derivative. It is cell cycle non-specific and interferes with DNA replication. In COP protocols, it may be given intravenously, or more commonly in cats, orally. Oral therapy means that the cat spends less time in the hospital, and placement of a catheter is not required.

In common with other cytotoxic drugs, side effects include myelosuppression and gastrointestinal signs. A potential side effect of cyclophosphamide is sterile haemorrhagic cystitis, which is caused by excretion of irritant drug metabolite, acrolein — although cyclophosphamide-induced cystitis should be monitored for, it occurs uncommonly in cats.1,2,6

Vincristine
Vincristine (Oncovin) is a vinca alkaloid. It is a mitotic spindle inhibitor that impedes cell division. It is commonly used in the treatment of lymphoid tumours (eg, lymphoma). This drug must be injected through a carefully placed intravenous catheter — if it leaks into perivascular tissue, extreme irritation occurs, causing wounds which may be slow to heal and difficult to manage. Side effects include vomiting and/or diarrhoea; ileus, manifesting as constipation or pain/abdominal cramps; or, occasionally, neurological side effects. Vincristine is less likely to severely suppress bone marrow function than many cytotoxic drugs.1,2,6

Prednisolone
Prednisolone is a glucocorticoid. In addition to its anti-inflammatory effect, it binds to receptors in tumour cell nucleus and inhibits DNA synthesis, producing cytotoxicity. Many chemotherapy protocols include corticosteroids, often commencing treatment with relatively high doses, slowly decreasing the amount given to a maintenance dose, or stopping. Side effects include polydipsia, polyuria, polyphagia, iatrogenic hyperadrenocorticism, diabetes mellitus, hepatomegaly, muscle wasting and gastrointestinal signs.1,2,6
Various protocols are described for lymphoma in cats including:

- Low-dose and high-dose COP protocols (Table 1), often for the lifetime of the patient;
- 25 week (L)CHOP protocol (Table 2) (which adds rotating doses of doxorubicin into COP protocols ∓ initiating dose of L-asparaginase);
- single agent chemotherapy; eg, doxorubicin or lomustine (CCNU);
- or prednisolone alone.

The so-called ‘short’ CHOP (cyclophosphamide, doxorubicin, vincristine and prednisone) is considered by many oncologists to be the optimum lymphoma treatment protocol. CHOP in cats is a finite programme (finishing at 25 weeks) and includes doxorubicin. However, many veterinary practices prefer to omit the doxorubicin due to time constraints, costs and health and safety concerns for staff, clients and patients. L-asparaginase is also a costly drug, and may be often reserved for ‘rescue’ therapy.1,7–9

Whichever is chosen, the patient’s individual needs should be considered and owners carefully counselled in advance on what to expect.

**Table 2: 25 week (L)CHOP protocol**

<table>
<thead>
<tr>
<th>Week</th>
<th>Drug</th>
<th>Dosage</th>
<th>Route</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vincristine</td>
<td>0.5–0.7 mg/m²</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td>(±L-Asparaginase)</td>
<td>400 U/kg</td>
<td>SC/IM</td>
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<tr>
<td></td>
<td>Prednisolone</td>
<td>2 mg/kg q24h</td>
<td>PO</td>
</tr>
<tr>
<td>2</td>
<td>Cyclophosphamide</td>
<td>250 mg/m²</td>
<td>PO/IV</td>
</tr>
<tr>
<td></td>
<td>Prednisolone</td>
<td>1.5 mg/kg q24h</td>
<td>PO</td>
</tr>
<tr>
<td>3</td>
<td>Vincristine</td>
<td>0.5–0.7 mg/m²</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td>Prednisolone</td>
<td>1.0 mg/kg q24h</td>
<td>PO</td>
</tr>
<tr>
<td>4</td>
<td>Doxorubicin</td>
<td>25 mg/m²</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td>Prednisolone</td>
<td>1.0 mg/kg q24h</td>
<td>PO</td>
</tr>
<tr>
<td>5</td>
<td>No chemotherapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Vincristine</td>
<td>0.5–0.7 mg/m²</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td>Prednisolone</td>
<td>1.0 mg/kg q24h</td>
<td>PO</td>
</tr>
<tr>
<td>7</td>
<td>Cyclophosphamide</td>
<td>250 mg/m²</td>
<td>PO/IV</td>
</tr>
<tr>
<td>8</td>
<td>Vincristine</td>
<td>0.5–0.7 mg/m²</td>
<td>IV</td>
</tr>
<tr>
<td>9</td>
<td>Doxorubicin</td>
<td>25 mg/m²</td>
<td>IV</td>
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<tr>
<td>10</td>
<td>No chemotherapy</td>
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</tr>
<tr>
<td>11</td>
<td>Vincristine</td>
<td>0.5–0.7 mg/m²</td>
<td>IV</td>
</tr>
<tr>
<td>12</td>
<td>No chemotherapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Cyclophosphamide</td>
<td>250 mg/m²</td>
<td>PO/IV</td>
</tr>
<tr>
<td>14</td>
<td>No chemotherapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Vincristine</td>
<td>0.5–0.7 mg/m²</td>
<td>IV</td>
</tr>
<tr>
<td>16</td>
<td>No chemotherapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Doxorubicin</td>
<td>25 mg/m²</td>
<td>IV</td>
</tr>
<tr>
<td>18</td>
<td>No chemotherapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Vincristine</td>
<td>0.5–0.7 mg/m²</td>
<td>IV</td>
</tr>
<tr>
<td>20</td>
<td>No chemotherapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Cyclophosphamide</td>
<td>250 mg/m²</td>
<td>PO/IV</td>
</tr>
<tr>
<td>22</td>
<td>No chemotherapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Vincristine</td>
<td>0.5–0.7 mg/m²</td>
<td>IV</td>
</tr>
<tr>
<td>24</td>
<td>No chemotherapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Doxorubicin</td>
<td>25 mg/m²</td>
<td>IV</td>
</tr>
</tbody>
</table>

If the cat is in complete remission at week 25, all therapy stops and monthly re-evaluations are instituted.

**Key point**

‘Rescue’ therapy is the term used to describe a chemotherapy protocol used after relapse following the first protocol.
A closer look at...

expect, how their cat is likely to respond, potential side effects, cost, time, etc. For accuracy, dosage is calculated on milligrams-per-metre-squared, based on the cat’s body surface area. Patients on COP-based protocols are treated as outpatients, allowing them to spend as much time at home, and the least time in the clinic as possible.

Nursing considerations

Patient handling
Nurses have a responsibility to treat all patients in their care in a respectful way that does not cause fear or involve force or coercion. This is particularly relevant when handling cats which may experience anxiety/distress within the clinic environment unless care is taken to address their needs. Ensuring slow, gentle handling in a quiet environment, allowing the patient to have control over how things progress and taking breaks, can have a positive impact on the cat’s emotional state during treatment.11,12

Adverse effects
Although the beneficial effects of chemotherapy against the cancer generally outweigh the potential side effects in skilled hands, almost all anti-cancer drugs have side effects. Toxicities may manifest at any time during chemotherapy treatment, from hours–days–weeks after administration, depending on the drug. Commonly affected body systems include those with rapidly dividing cells (eg, the gastrointestinal tract, bone marrow, skin/haircoat). A good knowledge of the drugs and their likely side effects is essential to nurse these patients, and prevention is better than cure.4,13,14

Chemotherapy administration and safety

Handling chemotherapeutic drugs raises certain health and safety concerns. For these reasons, it is important that written safety protocols and standard operating procedures be established and followed by all staff, and cat owners are also advised on potential human health risks. Chemotherapy should only be administered by trained and experienced staff. Personal protective equipment (PPE) should be worn to administer, assist with, clean up after chemotherapy, as well as to handle contaminated waste. Ideally, the use of a laminar flow fume hood is advocated for drug preparation, but failing that, employing a closed sealed administration system (eg, Phaseal) should be used as a minimum (Figure 2).2,13,14 In some countries chemotherapy drugs can be ordered directly in correct dosage (eg, Chemopet in the UK; www.chemopet.co.uk).

Figure 2: Use of sealed/closed systems, such as Phaseal (shown here), with screw-on syringes and connectors, is recommended for chemotherapy administration.
Comfort management
Comfort management is central to maintaining quality of life, and compassionate care requires that patients are kept as free as possible from the adverse effects of their cancer and its treatment.

Any tumour may cause pain, depending on which body system is affected, and the extent of the tumour. Diagnostic or therapeutic procedures, although considered palliative and pain relieving in themselves, may compromise welfare if pain is induced, particularly if there is pre-existing chronic pain such as osteoarthritis. Whatever the aetiology of pain in feline lymphoma patients undergoing chemotherapy, they should be managed by constantly re-evaluating, tailoring of analgesic protocols to address their changing needs, using a multimodal pharmacological approach, and excellent nursing, both at home and in the hospital. Consider the use of topical local anaesthetic for blood sampling and intravenous catheter placement; and ensure catheters are cleanly placed to reduce the risk of extravasation (Figure 3). Allow the patient to settle on a padded, non-slip surface, working around them and avoid over-extending joints.11–13,15

Keeping the facial area clean and clear of discharges is important. Sick cats may not groom so, if the patient is accepting, gentle daily grooming may improve comfort. Fear and distress, as well as learned patient expectation in the clinic, should also be considered and managed, especially in view of the multiple/repeated treatment experiences these cats must undergo. Using a low-stress approach and considering anxiolytic medications/sedation can improve cat’s welfare during treatment (Figure 4).11,15

Supportive care for the owner
Owning a cancer-bearing cat may be stressful and therefore many owners are suffering too. Veterinary nurses are perfectly placed to liaise and communicate with clients. Time should be spent with owners to counsel them on what to expect during their cat’s chemotherapy, the anticipated chances and duration of remission, potential side-effects and estimated cost of treatment, so that informed decisions can be made. Giving owners some simple, practical home-nursing information can empower them to help their
cats. Also ensure owners feel confident to call the clinic if they are worried about their cats at any time.

**Handling hazardous excretions**

Chemotherapy patients’ excretions may be hazardous but, with the right precautions, it is safe for cats to take part in normal interactions with family members, which is important for all. Owners must be made aware of necessary health and safety precautions — while it is important not to frighten people, it is imperative to point out potential hazards associated with human exposure to metabolites of cytotoxic drugs. There should be clear instructions to cat owners for at-home administration and handling of the drugs (ie, cyclophosphamide), and for dealing with drug-contaminated urine and faeces, such as cleaning out litter trays or handling vomit.10,12,15

### Outcomes of COP-based protocols

Which COP-based chemotherapy protocol is chosen for feline patients will depend on the clinician, the disease type, the owner’s wishes, financial constraints, the practice facilities, and staff knowledge and experience. Patient outcomes will vary, depending on individual-specific factors, as well as the lymphoma location, grade and stage and any comorbidities.

While in dogs, the CHOP protocol is considered the ‘gold standard’ treatment for lymphoma, in cats a high-dose COP protocol may be equally effective. In general, survival times may be between 3–9 months (eg, low-dose COP), or 6–18 months (eg high-dose COP or CHOP), but survival is very variable, some cats still being alive and well beyond 2 years. An important prognostic factor is response to treatment, so if a cat responds well and goes into remission, it is likely to have a longer survival than a cat which only partly responds to the chemotherapy protocol.

### Conclusions

Whatever the chosen protocol, veterinary nurses have a vital role to play in the care of chemotherapy patients and in maintaining the health and safety of the cat, client and staff. Careful administration of cytotoxic drugs and subsequent patient monitoring should avoid many potential complications.

While individual outcomes cannot be predicted, the use of COP-based protocols can improve quality of life and welfare for cats, as well as increase longevity and be used in first-opinion practice.

### 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.

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How to...

Home care for the cat with chronic kidney disease

Chronic kidney disease (CKD) is common in older cats. Clinical signs include weight loss, and drinking and urinating more frequently. Management of CKD requires more than one therapy and owners should be involved in the cat’s treatment. Diet, for example, may prolong life in cats with CKD and careful introduction of a renal diet will improve acceptance. Clients can also increase water intake at home, ensure resources are easily reached and reduce stress in the environment. Nurses and technicians should be involved in informing and supporting clients in caring for their cat with CKD.

Chronic kidney disease (CKD) is an unfortunately common cat disease. Previously called ‘kidney failure’, it is most commonly diagnosed in cats over 10 years of age, and it may affect more than 30–40% of cats in this age group, the percentage even higher in cats over 15 years of age. Although there is no cure for CKD, we can try to slow the progression of the condition, and ensure affected cats have a good quality of life. Part of effective holistic care of affected cats includes care provided by owners at home.

What is CKD?
The kidneys have many roles in the body, including managing fluid balance, regulating electrolytes, production of hormones and excreting waste products (via the production of urine). When the kidneys do not perform these functions, various consequences occur for the cat. Affected cats may show no signs of illness in the early stages (stressing the importance of senior cat healthcare), but as the condition progresses the most common signs include:
• polydipsia and polyuria;
• reduced appetite;
• weight loss;
• lethargy (this can be hard to appreciate in cats, but may manifest as reduced interaction with owners, or reluctance to play);
• vomiting.

Other signs may occur in later stages such as weakness, halitosis and signs due to complications of CKD such as high blood pressure (hypertension). Cats with untreated hypertension may become acutely blind (Figure 1).
How to...

What causes CKD?
In most cases, the cause of CKD is unknown. As the kidney is limited in the way it responds to injury, biopsies from cats diagnosed with some form of kidney disease tend to show the same changes (termed ‘chronic interstitial nephritis’). Some causes of CKD are recognised and include:

- **polycystic kidney disease**: a genetic condition seen in Persian and related cats;
- **bacterial infections of the kidneys**;
- **cancers affecting the kidneys**;
- **hypercalcaemia**;
- **inflammatory diseases**: these are less common but include conditions such as glomerulonephritis (inflammation of the filtration unit of the kidneys, resulting in protein loss into the urine);
- **acute kidney injury**: CKD can occur following acute kidney injury, most frequently as the result of toxin ingestion (eg, Lilies) or a drug side effect.

How is CKD diagnosed?
CKD is diagnosed on blood and urine test results, indicating a build up of substances in the blood normally cleared by the kidneys. Traditionally, urea and creatinine are measured (elevated levels termed ‘azotaemia’), but these parameters can be affected by other non-kidney factors such as fluid balance (eg, they can be elevated in dehydrated animals without kidney disease). Hence, it is important to combine the blood test results with urine tests. The kidney with chronic disease loses its ability to concentrate urine (with dehydration the urine should become concentrated). Therefore, the combination of elevated urea and creatinine, plus poorly concentrated urine confirms the diagnosis of CKD.

More recently laboratories have offered another test on blood, SDMA (symmetric dimethylarginine), which may allow earlier detection of CKD.

Key point
Measuring SDMA in the blood may offer an opportunity to diagnose CKD before creatinine is elevated.

Key point
Polydipsia and polyuria may not be appreciated by owners, particularly if cats urinate outside. For cats using a litter tray, it may be heavier, and cats may be noted to visit water sources more often.

Figure 1: This cat presented to the veterinary clinic with sudden blindness. Both pupils are dilated and in the left pupil the white line indicates a detached retina. This is the result of high blood pressure due to CKD, and may be the first sign noticed by the owner. (Photograph courtesy of Tim Knott)
but should be measured with urea/creatinine and analysis of urine. In addition to azotaemia, the cat with CKD may have other changes on blood tests such as low potassium and high phosphate, and may become anaemic in later stages. Further tests such as culturing the urine for bacteria and measuring the amount of protein lost from the kidneys are also advised.

**How is CKD treated?**
CKD cannot be reversed. Currently, treatment in approached in three ways:
- prevention of further kidney injury;
- management of the complications of CKD; and
- slowing progression of CKD.

**Prevention of further kidney injury**
If a cause for CKD is identified, then it should be promptly treated (for example, bacterial infection). Similarly, if a patient is suspected of, or diagnosed with, CKD then every effort should be made to prevent further injury; for example, by avoiding drugs that may be harmful to the kidneys and ensuring the kidneys are protected during anaesthesia by maintaining an appropriate blood pressure. Some aspects of home care (such as increasing water intake) can also help prevent further injury, by preventing dehydration.

**Management of the complications of CKD**
Once the diagnosis of CKD is made, further tests should be performed to look for complications of CKD and that should be treated. Table 1 summarises the management of complications of CKD.

<table>
<thead>
<tr>
<th>Complication</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>High blood pressure</td>
<td>Amlodipine (a vasodilator)</td>
</tr>
<tr>
<td>Hypokalaemia</td>
<td>Renal diets are supplemented with potassium, and some cats will need an additional supplementation</td>
</tr>
<tr>
<td>Anaemia</td>
<td>In some cases erythropoietin analogues are used in later stage CKD</td>
</tr>
<tr>
<td>Nausea and vomiting</td>
<td>Antiemetic drugs have been shown to be helpful for some cats</td>
</tr>
<tr>
<td>Proteinuria (excessive protein in the urine)</td>
<td>Angiotensin converting enzyme (ACE) inhibitors, or angiotensin receptor blockers (ARBs) are used if tests show high levels of protein in urine</td>
</tr>
<tr>
<td>Urinary tract infection (UTI)</td>
<td>Regular checks and treatment of UTIs based on culture results</td>
</tr>
<tr>
<td>Inappetence</td>
<td>Cats should be thoroughly assessed for other concurrent diseases and if nausea, etc, is managed, then an appetite stimulant may be used in some cases. Feeding tubes can be placed if required (these can also be used to provide extra water)</td>
</tr>
<tr>
<td>Hyperphosphataemia</td>
<td>Feeding a kidney (renal) diet and additional phosphate binders if indicated</td>
</tr>
</tbody>
</table>
How to...

Dietary management of CKD

Dietary management of CKD is very important, and to date is the only treatment shown to prolong life in CKD cats. Diet is important for the following reasons:

- **It is restricted in protein:** the toxic products of protein breakdown cannot be effectively removed by the diseased kidneys so a restricted, digestible protein is desirable.
- **It is lower in phosphate:** restricting phosphate appears to prolong life in CKD cats.
- **It has added potassium:** low potassium may cause weakness and inappetence.
- **Other components:** essential fatty acids may be supplemented in renal diets and they are non-acidifying.

Therefore, it is important to see diet as a ‘treatment’ and attention focused on improving the cat’s acceptance of the new renal diet.

Slow progression of CKD

Much research in human medicine, and some in veterinary medicine, has focused on slowing the progression of CKD. This has shown that cats with lower blood phosphate levels live longer than those with higher phosphate levels, so controlling phosphate is a treatment target. This is undertaken mainly with dietary management, by providing diets with lower levels of phosphate than normal diets. Research is ongoing on the whether other treatments can prolong life in CKD cats.

Tip

Spend time explaining to clients how to introduce a renal diet, as it has been shown to prolong life in cats with CKD.

So, what can we do at home?

There is no single tablet or treatment that will cure/manage CKD. A holistic approach to affected cats is needed and this includes care at home. Owners should not just be sent home with a bag of renal diet! There is a lot that can be done to make cats more comfortable.

**Increase water intake**

Cats with CKD cannot concentrate their urine so they need to drink more to maintain normal hydration. Becoming dehydrated is detrimental to kidney health. Ways to increase water intake include:

- Changing to a wet diet.
- Adding water to food — this only works if the cat continues to eat, so try a tiny amount to begin with.
- Using the most ‘cat-friendly’ system for providing water. Wide brimmed ceramic bowls (Figure 2) are preferred over metal or plastic. They should also be filled to the brim. Bowls should be provided in more than one location, and away from food and litter trays.
- If the cat goes outside then have a bowl in the garden, rainwater is preferred over cleaner tap water by many cats.
- Use water fountains, as running water is favoured by some cats.
- Offer flavoured water; eg, the water from a can of tuna, water that chicken has been cooked in (not chicken stock as the onions and salt will not be good for the cat).
- Some cats will need fluid therapy at the vets, and select cases may benefit from subcutaneous fluids given at home.
Maintain nutrition
Dietary management of CKD may slow progression of the disease. However, this is not as simple as filling the bowl with the new diet and leaving the cat to it. It is very important that cats with CKD eat, (periods of starvation can be harmful for any cat). How the diet is introduced can make a great difference to the cat’s long-term acceptance of the diet. Cats often have strong dietary preferences, and habits are hard to break. Consider the following:
• Making the change over several days to weeks, don’t rush it!
• Don’t try and introduce the renal diet when the cat is unwell, as they may associate the diet with nausea which can lead to food aversion.
• Some cats will tolerate a small amount of the new diet mixed with the old diet and slowly the amount of the new diet increased.
• The new diet can be offered in a separate bowl from the old diet. Once the cat is eating some of the new diet, the amount of the old diet is reduced gradually.
• Try more than one texture/flavour/brand. Some cats prefer one over another, and some like a rotation between flavours.

In some cases, an appetite stimulant can be prescribed to help overcome reluctance to try the new food.
• Warming food can increase acceptance.
• Don’t try and hide medications in the renal diet as this could create aversions.

In general, older cats may have a reduced appetite and should be offered food little and often. Ensure they are not bothered when eating (eg, by other pets) and that they can easily reach their food (this age group of cats are often arthritic). If a cat will not accept a renal diet, then some senior diets may be used as an alternative, but the protein and phosphate levels should be assessed as these vary widely.

Monitoring the cat with CKD
As cats are the masters of hiding illness, owners should be informed how to notice when their cat is unwell. Combining regular veterinary checks (eg, blood pressure assessment every 3–6 months) with owner observations at home, allows early diagnosis of problems or deterioration in cats with CKD.

Clients should be involved in their cat’s care as follows:
• monitoring appetite: a reduction in appetite may be the first indication something is not right;
• monitor for signs of urinary tract infection (UTI): visiting the litter tray frequently, overgrooming the abdomen or perineum for example (importantly some cats with urinary tract infections will be asymptomatic so check-ups at the clinic are important);
• collection of free-catch urine samples: checking protein levels and for indications of UTIs is important in cats with CKD.

Learning how to collect a urine...
How to...

**Reducing stress**

Some cats with CKD will live for several years in relatively good health. Although stress is not directly linked to CKD, it makes sense to ensure these patients are not distressed. Environmental enrichment is important as well as ensuring resources are easy to access for cats with osteoarthritis and mobility issues. For CKD cats the same applies, access to resources such as food, water, and a quiet comfortable bed are vital (Figure 4). As a cat with CKD may urinate more than a healthy cat, litter provision should be optimised ensuring there are enough litter trays for all cats in the home, of adequate size, and also that the litter trays are changed more frequently.

- **monitor for signs of reduced quality of life:** CKD is a progressive condition and affected cats can have periods where kidney function declines. Equally, at the end of a cat’s life hard decisions need to be made. Owners of CKD cats can monitor their cat’s quality of life by keeping note (using a diary can be helpful) of food intake, activity, play, engagement with family or other pets. This may help identify a problem promptly, or help with challenging end of life discussions.

**Key point**

Cats with CKD are usually senior cats, and may have other conditions such as osteoarthritis. Clients can alter the cat’s environment to make resources easily accessible, reducing stress and optimising food and water intake.

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sample can provide lots of information. Non-absorbant litter is available (Figure 3) and aquarium gravel also makes a good substitute;  

- **monitor for signs of reduced quality of life:** CKD is a progressive condition and affected cats can have periods where kidney function declines. Equally, at the end of a cat’s life hard decisions need to be made. Owners of CKD cats can monitor their cat’s quality of life by keeping note (using a diary can be helpful) of food intake, activity, play, engagement with family or other pets. This may help identify a problem promptly, or help with challenging end of life discussions.

**Prognosis**

Many cats with CKD survive for several years if diagnosed at an early stage. Prompt diagnosis and treatment can make all the difference, emphasising the importance of the promotion of senior cat healthcare in veterinary clinics. It is a progressive condition, but with appropriate treatment, and a proactive approach to home care, quality of life can be optimised for as long as possible.

**Further reading**

Nursing the pyothorax patient

Pyothorax is an accumulation of purulent fluid in the pleural cavity, and is associated with dyspnoea, tachypnoea and hypoxia. These cases can be challenging, but ultimately rewarding to nurse; intensive nursing care is required initially, with management of thoracostomy tubes, thoracic drainage and lavage, close monitoring of respiration and pain, and general supportive care. In this case Otto, a 3-year-old British Shorthair, presented as an emergency referral with pyothorax. Management of the condition included pre-anaesthetic stabilisation, diagnostic imaging and thoracostomy tube placement, supportive treatment and appropriate nursing care.

Pyothorax is associated with an accumulation of septic, purulent fluid in the pleural space. The pleura are serous membranes which encase the lungs and line the thoracic cavity; the pleural cavity (or pleural space) exists between these two membranes. This space normally contains a small amount of pleural fluid, which allows the body wall and thoracic organs to move without friction during respiration.

The pleural space may become filled with air (pneumothorax) or effusions such as blood (haemothorax), chyle (chylothorax), purulent material (pyothorax) or transudate (hydrothorax). In such cases, the lungs become separated from the thoracic wall and compressed by the pleural air/liquid. This compromises respiration and causes tachypnoea, dyspnoea and hypoxia.

Limited evidence currently exists on the incidence of pyothorax in cats; causative agents are not easily identified, with underlying causes reported in 35–67% of cases. Suggested causes of pyothorax in cats include parapneumonic spread, foreign bodies, penetrating thoracic wounds, haematogenous spread and iatrogenic causes.

This report details the management of a 3-year-old British Shorthair cat presented with pyothorax. Initial stabilisation, diagnostic imaging, thoracostomy tube placement and...
postoperative nursing care, including thoracic drainage and lavage, are discussed.

**History and signalment**

Otto, a 3-year-old British Shorthair, presented as an emergency referral with a 3 week history of lethargy, pyrexia and decreased appetite, progressing to tachypnoea and coughing 2 days prior to referral. The referring practice diagnosed a pyothorax following thoracic radiography and thoracocentesis, and initiated treatment with intravenous amoxicillin/clavulanic acid (Augmentin; GlaxoSmithKline), meloxicam (Metacam; Boehringer Ingelheim) and buprenorphine (Vetergesic; Ceva).

On admission Otto was quiet, but alert and responsive. He weighed 4.8 kg and had a body condition score of 4/9. His heart rate was 164 beats/min with a regular rhythm and he had matched, good quality pulses. The heart did not sound markedly muffled on auscultation. Otto’s respiratory rate was 48 breaths/min with increased lung sounds bilaterally (left side worse than right) and his mucous membranes were pink and moist with a capillary refill time of <2 s. Temperature measurement was not performed initially, to avoid causing additional stress to Otto and subsequently exacerbating his dyspnoea.

Otto was admitted for stabilisation, computed tomography (CT) of his thorax and bilateral thoracostomy tube placement.

**Pre-anaesthetic nursing**

After consultation and admission into the cat ward Otto was placed on oxygen in an incubator for 3 h and respiratory rate, pattern and effort monitored every 30 mins.

After this time, Otto was no longer oxygen-dependent and his respiratory rate was stable at 56 breaths/min with pink mucous membranes, therefore general anaesthesia was performed.

**Procedure**

Otto received a premedication with dexmedetomidine (Dexdomitor; Zoetis) 1.5 μg/kg intravenously (buprenorphine [Vetergesic; Ceva] 0.02 mg/kg had already been given on admission) before alfaxalone (Alfaxan; Jurox) was administered at 2 mg/kg intravenously and a 5 mm endotracheal tube placed. Otto was then placed on a multi-parameter monitor (capnography, pulse oximetry, electrocardiography, continuous temperature monitoring and non-invasive blood pressure monitoring [Cardiocap 5; Datex-Ohmeda]) and placed in sternal recumbency.

In order to evaluate the lungs fully on the CT scan, bilateral thoracostomy tubes were placed and thoracic drainage performed prior to CT. Otto was clipped bilaterally from the last rib to cranial thorax, and the surgical sites

Figure 1: Cytology at time of thoracostomy tube placement showing high numbers of neutrophils and intra- and extracellular bacteria. (Courtesy of Lumbry Park Veterinary Specialists)
prepared using 2% chlorhexidine gluconate solution and a sterile 2% chlorhexidine in 70% isopropyl alcohol applicator (Chloraprep; CareFusion). Bupivacaine 0.25% (Marcain; Astrazenca) was infiltrated into the intercostal muscles to provide additional analgesia, before 14 gauge x 8” thoracostomy tubes (Chest Tube Kit; MILA) were placed bilaterally using the Seldinger technique and secured with polypropylene sutures (Prolene 4–0; Ethicon). A one-way valve (Centesis valve; MILA) was aseptically connected to each thoracostomy tube and the thorax was drained. Fifty millilitres of turbid, odourous, purulent material was obtained from the left hemithorax, and 61 ml obtained from the right. In-house cytology documented a mix of degenerate neutrophils (70%) macrophages (25%) and lymphocytes (5%) with intra- and extracellular cocci and rods (Figure 1). A sample was sent for microbiological culture and antibiotic sensitivity, which confirmed the presence of *Bacteroides pyogenes*.

After drainage Otto was transferred to CT and a plain thoracic scan was performed (Figure 2). This showed both drains terminating in thick material in the mediastinal region. Lung inflation was adequate, especially caudally, but some residual fluid and fibrous material was still present in the pleural cavity. Minimal pneumothorax was observed following thoracostomy tube placement.

**Post-anaesthetic nursing**

Otto began the following treatment plan under direction of the veterinary specialist:

- **intravenous fluid therapy**: Hartmann’s solution at 3 ml/kg/h;
- **analgesia**: buprenorphine (Vetergesic; Ceva) at 0.02 mg/kg IV, q6h;
- **antibiotic therapy**: clindamycin (Dalacin C; Pfizer) at 10 mg/kg IV, q12h and marbofloxacin (Marbocyl; Vetoquinol) 2 mg/kg IV, q24h;
- **intermittent thoracic drainage**: (q6h), with thoracic lavage if little fluid recovered.

**Management of thoracostomy tubes**

Otto’s thoracostomy tubes were drained every 6 h, and the volumes of fluid and air retrieved were recorded for each side. Fluid appearance, odour and turbidity were also recorded, and cytological evaluation was repeated daily.

During drainage, particular attention was paid to the gate clamps on the tubes, and one-way valves were utilised, to prevent iatrogenic pneumothorax. Drainage was performed slowly, with flow-by

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**Figure 2:** CT scan after bilateral thoracostomy tube placement and thoracic drainage, showing good caudal lung inflation, but residual material in the mid thorax. (Courtesy of Lumbry Park Veterinary Specialists)
Case study

oxygen available, and care was taken not to apply excessive negative pressure, as negative pressures exceeding 3–5 ml can cause pleural trauma.2

Aseptic technique was adhered to when handling the tubes, to avoid bacterial contamination and ascending infection. Sterile gloves were worn when handling, and needle-free valves were placed over each tube. Isopropyl alcohol disinfecting caps (Curos Caps; Vygon) were placed over the needle-free valves and replaced after each drainage. The thoracostomy tube sites were checked, cleaned and re-dressed every 24 h; a polyhexamethylene biguanide (PHMB) anti-microbial foam disc (AMD; Kendall) was placed at each site which provides anti-microbial activity for up to 7 days. These are considered superior to topical antibiotic ointment application, which can contribute to multi-drug resistant infections.4 A medical pet shirt (MPS Shirt; JAK Marketing) was used to secure the tubes and dressings against the body wall (Figure 3).

Daily cytological evaluation documented a steady improvement (Figure 4); therefore, thoracic lavage was not required in Otto’s case. However, thoracic lavage can be used in severe cases to break down consolidated debris and accumulated pus, debride the pleural cavity, reduce effusion viscosity and prevent thoracostomy tube blockage.1 There are currently no evidence-based guidelines regarding the optimal lavage solution, frequency of treatment, lavage dwell time or duration of treatment.1 In the author’s practice, lavage is performed depending on the volume, viscosity and cytological evaluation of pleural fluid recovered. 10–20 ml/kg of warmed, isotonic crystalloid solution is instilled, via the thoracostomy tubes, into the pleural space and left in situ for 10–20 mins before removal. Lavage can be performed with isotonic crystalloid solutions, or crystalloid and antibiotic combinations; the

Key point

When draining thoracostomy tubes, ensure gate clamps and one-way valves are used correctly to avoid iatrogenic pneumothorax.
The latter has been associated with shorter recovery times.\(^3\)

Careful monitoring of the patient’s respiration is indicated as this may be compromised due to instillation of the lavage solution, and oxygen should be available. It is also suggested that, in cats, thoracic lavage can contribute to volume overload as inflamed pleural tissues can absorb lavage fluid; close monitoring and recording of fluids instilled via, and recovered from, the thoracostomy tubes is therefore indicated.\(^1\)

The amount of fluid recovered from Otto’s thoracostomy tubes steadily decreased, and alongside marked improvement in cytological analysis, they were removed after 5 days. Following removal, Otto’s respiration was monitored every 6–8 h; his respiratory rate remained at 24 breaths/min with normal effort post-removal. The tube insertion sites were cleaned daily with 2% chlorhexidine gluconate solution and an adhesive dressing (Primapore; Smith and Nephew) placed. This was covered with a medical pet shirt to prevent self-trauma.

Monitoring and general nursing care

Upon recovery from general anaesthesia Otto’s condition remained stable and he was not oxygen-dependent. Routine temperature, pulse and mucous membrane colour/capillary refill time measurements were taken every 12 h; these documented pyrexia initially with a temperature of 39.7°C the day after admission. This resolved after a further 48 h of treatment.

Otto’s respiratory rate, pattern and effort was monitored and recorded every 4 h. The day after admission his respiratory rate remained around 40 breaths/min; over the following 48 h this reduced to 24 breaths/min with normal effort. Pain was assessed every 6 h using the short form of the Glasgow Composite Pain Scale and analgesia provided as necessary; this was stopped following thoracostomy tube removal.

As Otto was anxious in hospital monitoring frequency was reduced, and treatments/medications grouped together where possible to avoid disturbing him excessively. A Feline Fort (Cats Protection) was provided, to allow him to hide, and a nursing questionnaire filled in by the owners at admission, allowing his hospitalisation environment to match his normal routine as much as possible. Otto was housed in a feline-only ward with feline facial pheromone F3 (Feliway; Ceva) diffusers in use; any treatments were carried out in a feline-only treatment setting.

Tip

Group treatments and assessments together for anxious cats to avoid unnecessary handling.
Case study

room, to avoid association of his kennel with any stress, and if Otto required transporting to a different area of the hospital his carrier was covered with a blanket. After 48 h, Otto’s demeanour markedly improved and he became more confident and affectionate.

Otto began eating voluntarily the day after his admission; his resting energy requirement (RER) was calculated daily and volume of food ingested recorded. Each morning, his body weight was recorded and adjustments to his calorific requirement made as necessary. As Otto consumed 80–100% of his RER each day, assisted feeding was not required. If this intake had reduced, or he had lost weight (which could not be attributed to thoracic drainage), a naso-oesophageal feeding tube would have been considered.

Discharge and repeat examinations
Otto was discharged after 8 days of hospitalisation. He continued clindamycin and marbofloxacin per os after discharge and was seen for repeat examination and thoracic radiographs at 5 weeks post-discharge. At this appointment, Otto’s owner reported a positive change in his demeanour, respiration, energy levels and food intake; clinical examination was unremarkable and Otto had gained 200 g in weight. Otto received sedation for thoracic radiographs; this documented an improvement in lung inflation, though some material was still present. Otto therefore continued antibiotic therapy for a further 4 weeks and CT was repeated at this stage. This showed a further improvement but not yet a full resolution, so Otto continued antibiotics for a further 4 weeks and a repeat CT scan obtained at the end of this course. At this appointment, 3 months after initial presentation, Otto’s thorax had markedly improved, with only a small area of consolidation seen on CT (Figure 5). This was considered to be an area of permanent scarring/adhesion formation following the pleural inflammation, and considering this in combination with Otto’s clinical presentation, his treatment was stopped. Otto has since made a full recovery.

References

Figure 5: Otto’s final CT scan documented a marked improvement compared with initial presentation. (Courtesy of Lumbry Park Veterinary Specialists)