INTRODUCTION
In the first paper we discussed the pathophysiology of diarrhoea in dogs and cats. The present paper discusses treatment regimes. In the case of acute non-life-threatening diarrhoea supportive management of clinical signs may be appropriate. However when chronic diarrhoea exists further investigations are required to identify the underlying aetiology and provide a more specific guide to management (Fig. 1).

MANAGEMENT OF ACUTE DIARRHOEA
There are a large number of potential causes of acute diarrhoea (Table 1), the clinical presentation of which can range from life-threatening illness to diarrhoea without additional clinical signs.

Acute life-threatening diarrhoea requires aggressive management of dehydration, electrolyte and acid-base imbalances and, if present, septicaemia (most commonly due to enteric bacterial translocation). Immediate efforts to identify the underlying cause are essential and should be carried out in parallel with emergency treatment regimes. Management of these cases is beyond the scope of this paper.

In the case of non-life-threatening acute diarrhoea, where the animal is not dehydrated or vomiting and is able to drink adequately to maintain hydration, management of clinical signs on an outpatient basis is appropriate. Such treatment may be usefully divided into dietary management and drug therapies. In some cases only dietary management will be necessary whilst in others both regimes are required.

Dietary management of acute diarrhoea

Starvation
Although there is now some evidence in people that ‘feeding through’ diarrhoea with appropriate diets may be beneficial, it is unclear whether the same is true for cats and dogs. Most acute diarrhoeas in man are secretory in origin whereas osmotic diarrhoea is more common in cats and dogs. In the latter a 24-48 hour starvation period (ensuring adequate access and intake of water) reduces faecal volume and prevents ‘accidents’ in the house. The period of starvation should not be prolonged as enteral nutrition is essential for maintaining intestinal mucosal health.

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**DIARRHOEA**

| Self limiting, non-life threatening | Life threatening | Small intestinal | Chronic |
|-----------------------------------|------------------|------------------|---------|
| • Ensure adequate hydration       | • Aggressive management as appropriate paying particular attention to management of dehydration, electrolyte and acid-base imbalances | • 3x faecal culture | • 3x faecal culture |
| • Maintain adequate oral fluid intake | • Watch for septicaemia and treat aggressively         | • Faecal parasite analysis (incl ZnSO₄ flotation or ELISA for Giardia) | • Rectal exam |
| • Starve 12-24 hours             | • Further investigation of underlying cause             | • Treatment of infectious diseases as appropriate | • Faecal parasite analysis (incl ZnSO₄ flotation or ELISA for Giardia) |
| • Easily digestible, fat restricted diet for 3-7 days (4-6 meals per day) |                        | • Anthelmintic treatment (fenbendazole 50mg/kg PO q 24h x 3 days as Giardia can be difficult to exclude on faecal analysis) | • Treatment of infectious diseases as appropriate |
| • Anthelmintic treatment      |                        | • Cobalamin/folate | • Anthelmintic treatment (fenbendazole 50mg/kg PO q 24h x 3 days as Giardia can be difficult to exclude on faecal analysis) |
| • If diarrhoea persists or clinical condition worsens further investigation warranted |                        | • TLI if weight loss or steatorrhoea | • Haematology/biochemistry/urinalysis (incl T4 in cats) |

**Small intestinal**

- 3x faecal culture
- Faecal parasite analysis (incl ZnSO₄ flotation or ELISA for Giardia)
- Treatment of infectious diseases as appropriate
- Anthelmintic treatment (fenbendazole 50mg/kg PO q 24h x 3 days as Giardia can be difficult to exclude on faecal analysis)
- Cobalamin/folate
- TLI if weight loss or steatorrhoea
- Haematology/biochemistry/urinalysis (incl T4 in cats)
- Imaging
- Dietary trial
- Intestinal biopsy

**Large intestinal**

- 3x faecal culture
- Rectal exam
- Faecal parasite analysis (incl ZnSO₄ flotation or ELISA for Giardia)
- Treatment of infectious diseases as appropriate
- Anthelmintic treatment (fenbendazole 50mg/kg PO q 24h x 3 days as Giardia can be difficult to exclude on faecal analysis)
- Haematology/biochemistry/urinalysis (incl T4 in cats)
- Imaging
- Dietary and fibre trial
- Intestinal biopsy

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Fig. 1: Investigation and management of diarrhoea
Diets
Following the period of starvation an easily digestible, moderately fat restricted low fibre diet should be fed frequently (4-6 small meals per day) for 3-7 days before re-introducing the original diet. Commercial diets are available or a home prepared diet of cottage cheese or boiled chicken and rice are suitable. Cats are less tolerant of carbohydrate and more tolerant of fat, therefore a diet restricted to boiled chicken is more appropriate in this species. Anthelmintic treatment is appropriate at this stage particularly in young animals where parasites may be the cause of the diarrhoea. In many cases this will result in a complete resolution of symptoms without the need for pharmacologic treatment.

If a period of starvation and dietary restriction does not result in resolution of clinical signs, and in more severe cases, additional pharmacological management may be used to improve the treatment outcome. Proven efficacy of drugs used in the management of acute diarrhoea is in general lacking.

Drug therapies for acute diarrhoea
Antibiotics
Except in the case of life-threatening diarrhoea where bacterial translocation is a potential problem, antibiotic treatment is not indicated for the management of acute diarrhoea and may be contraindicated in some infections e.g. salmonellosis where the animal is not otherwise systemically unwell. Antibiotic ‘over use’ in diarrhoea cases may lead to a variety of side-effects (Table 2).

Anti-diarrhoeal agents
Various drugs have been suggested for the pharmacological management of acute diarrhoea (Table 3). Some are veterinary licensed products. Although anti-diarrhoeal drugs have different modes of action and pharmacokinetics in different species, the use of human preparations may be acceptable and preferable if there is no available veterinary alternative.

Kaolin and pectin are adsorbents that are reported to bind bacteria and toxins. They may also ‘coat’ the intestinal mucosa preventing further ‘irritation’ and may have antisecretory activity. The above actions have not been proven but improvement in faecal consistency has been observed although faecal volume, water and electrolyte loss remain unchanged. There are various veterinary licensed products and human products available.

Bismuth preparations include bismuth subsalicylate (no veterinary licensed products) and bismuth carbonate (UK veterinary licensed product: Genetrix diarrhoea tablets). Bismuth subsalicylate is transformed in the small intestine to bismuth carbonate and salicylate. Bismuth carbonate acts as a gastric protectant and is thought to have anti-endotoxic and weak antibacterial properties. The salicylate is thought to have an antisecretory action mediated via inhibition of prostaglandin production and inhibition of enterotoxin generated cAMP. The use of products containing subsalicylate should be avoided in cats as toxicity can occur. Bismuth subsalicylate works most efficiently where a secretory diarrhoea is present and is less likely to be beneficial in osmotic diarrhoea.

Loperamide and diphenoxylate (no veterinary licensed products) are opiate motility modifying drugs that help to restore segmental contractions and reduce peristalsis by direct action on gastrointestinal smooth muscle causing tonic and phasic contractions of the circular muscle thereby slowing gastrointestinal transit time. Loperamide and to a lesser extent diphenoxylate also inhibit secretion

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**TABLE 1: Causes of acute diarrhoea**

| Dietary Intolerance | Allergy |
|---------------------|---------|
| Sudden change in diet (e.g. scavenging, changing from dry to wet food, new diet) | |
| Toxin (spoiled food or other sources) | |

**Infectious**

| Viral (e.g. parvovirus, rotavirus, coronavirus) | Bacterial (e.g. Campylobacter, Salmonella, Clostridium perfringens) |
|-------------------------------------------------|----------------------------------------------------------|
| Parasitic (e.g. hookworms, roundworms, whipworms, Giardia) | |

**Drugs**

| Steroids | NSAIDs* | Antibiotics | Chemotherapy drugs |

**Extra intestinal**

| Acute pancreatitis | Acute liver disease | Acute renal disease (incl. leptospirosis) |

**Other**

| Haemorrhagic gastroenteritis | Foreign body | Intussusception | Idiopathic |

* NSAIDs non-steroidal anti-inflammatory drugs

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**TABLE 2: Side-effects of antibiotic over-use in diarrhoea cases**

| Disruption of normal gut microflora leading to: |
|-------------------------------------------------|
| Worsening diarrhoea due to maldigestion |
| Increased risk of enteric colonisation by pathogenic bacteria |
| Production of antibiotic resistance |
| Creation of antibiotic resistance (especially Salmonella) |
| Super infection |
| Mycotic infections |

**TABLE 1: Causes of acute diarrhoea**
from the crypt cells and stimulate absorption of water and electrolytes in the villous tips. Diphenoxylate can cause CNS side effects usually seen as sedation. Although loperamide is not reported to cross the blood brain barrier, hyperexcitability has been seen in cats and therefore the lowest effective dose for as short period of time should be used in this species. In Collies affected by the MDR-1 gene mutation loperamide may reach higher concentrations in the CNS resulting in increased CNS side-effects. Profound depression has been reported and loperamide should be used with caution in this breed. These drugs are contraindicated in cases of infectious or toxic diarrhoea as they reduce the gut transit time and therefore natural elimination of bacteria and toxins.

**Metronidazole** (no veterinary licensed products) in addition to its antibiotic and antiprotozoal properties is proposed to have anti-inflammatory and immunomodulatory properties that suppress cell-mediated responses and may be beneficial in the management of both acute and chronic diarrhoea. A short (5-7 day) course of metronidazole can be

### TABLE 3: Drugs used in the management of diarrhoea

| Drug                          | Examples                    | Action/Uses                   | Dose                           | Warnings                                      |
|-------------------------------|-----------------------------|-------------------------------|--------------------------------|-----------------------------------------------|
| Kaolin and pectins            | Kogel*, Canikur*, BCK granules* | Non specific antidiarrhoeal | Various, depending on product | Avoid preparations that include antibiotics or anticholinergics |
| Bismuth preparations          | Genetrix diarrhoea tablets, BCK granules*, Pepto-Bismol | Non specific antidiarrhoeal | Various, depending on product | Avoid use of products containing salicylate in cats. |
| Loperamide                    | Imodium                     | Opiate motility modifier. Acute diarrhoea. Idiopathic motility disorders. | Dogs and cats: 0.04-0.2 mg/kg PO q 8-12h | Do not use in cases where bacterial infection is present. May cause constipation and hyperexcitability in cats. Potential neurotoxicity in Collie breeds. |
| Diphenoxylate                 | Lomotil*                    | Opiate motility modifier. Acute diarrhoea. Idiopathic motility disorders. **Note:** contains atropine | Dogs: 0.05-0.1 mg/kg PO q 8h | Do not use in cases where bacterial infection is present. May cause constipation and hyperexcitability in cats (greater risk than with loperamide), care in dogs <10 kg. |
| Sulphasalazine                | Salazopyrin                 | Anti-inflammatory             | Cats: 10 mg/kg PO q 12h Dogs 15-30 mg/kg PO q 12h max. 6g/day | Keratoconjunctivitis sicca. Hepatotoxicity. |
| Olsalazine                    | Dipentum                    | Anti-inflammatory             | Dogs: 10 mg/kg PO q 12h | Keratoconjunctivitis sicca. |
| Metronidazole                 | Metronidazole, Flagyl       | Antibacterial, antiprotozoal, possibly anti-inflammatory and immunomodulatory drug. Acute colitis. Chemotherapy induced diarrhoea. IBD | 10 mg/kg PO q 12h (note this is lower than the standard antibacterial dose) | Neurotoxicity can occur with long term high dose treatment. Wear gloves, potentially carcinogenic in humans. |
| Tylosin                       | Tylan                       | Antibiotic. IBD, ARD          | Dogs and cats: 10-20 mg/kg PO q 12h | Appears to have a wide safety margin |
| Prednisolone                  | Prednisolone, Prednicare    | Anti-inflammatory, immunosuppressive | 1-2 mg/kg PO q 12-24h reducing dose over 6-8 weeks based on clinical response | Polyphagia, polydipsia, polyuria, gastroenteral ulceration. Do not use in combination with NSAIDs |
| Mebeverine                    | Colofac                     | Antispasmodic. Idiopathic motility disorders. | Dogs: 2 mg/kg PO q 8h | Efficacy and safety in dogs unknown. |
| Pancreatic enzyme             | Pancrex-Vet, Tryplase, Lypex | EPI                           | Dogs: 1-1.5 teaspoons per meal Cats: 1 teaspoon per meal | Contact dermatitis of lips may occur in some animals. Excessive doses may cause diarrhoea. |

For full information regarding indications, dose and side-effects refer to pharmacology texts (see further reading).

*contains ingredients in addition to the primary drug; refer to pharmacology texts for further information.

Products approved for use in the UK are in bold

PO - per os

IBD - inflammatory bowel disease
ARD - antibiotic responsive diarrhoea
EPI - exocrine pancreatic insufficiency
useful in managing acute colitis and anecdotally is reported to be useful in reducing the severity of clinical signs associated with chemotherapy induced diarrhoea. Metronidazole has previously been used in the treatment of giardiasis but the drug of choice for treating this disease is now fenbendazole.

**Tylosin** (no veterinary licensed products) is reported to have anti-inflammatory effects in the gastrointestinal tract although there is little evidence to support this at present. Despite this lack of evidence tylosin has been used successfully to manage both acute and chronic small and large intestinal diarrhoea.

**MANAGEMENT OF CHRONIC DIARRHOEA**

Chronic diarrhoea carries a large number of differential diagnoses (Table 4) and can be frustrating to treat. For this reason it is essential to determine the underlying cause so that specific treatment tailored to the animal’s needs can be provided. However in some cases such as antibiotic-responsive diarrhoea (ARD) and inflammatory bowel disease (IBD) no specific treatment is presently available and treatment is aimed at achieving a remission of clinical signs. Ultimately these patients tend to relapse requiring reassessment and alteration in treatment. Dietary management plays a key role in the long term management of chronic diarrhoea. Although there is no ‘universal’ diet for chronic diarrhoea single (novel) protein diets, low fat diets and diets with added fibre are most often employed. In addition to this, it is essential that feeding of treats, scavenging or alterations in diet are avoided.

Management of specific chronic diarrhoeal disorders

**Inflammatory bowel disease**

Diet is important in the management of IBD together with anti-inflammatory medication especially in the early stabilisation of the disease. Single novel protein diets should be used in the management of small intestinal IBD. Reducing the fat content of the diet can sometimes be advantageous. Addition of fructose oligosaccharides (FOS) is recommended if concurrent ARD is suspected. The choice of novel protein is dependent on the animal’s previous dietary exposure. It is therefore important to discuss previous dietary history thoroughly with the owner before selecting an appropriate novel protein.

Where large intestinal IBD exists a similar diet to that described above can be used but the level of fermentable fibre should be increased. Fermentable fibre is digested by the colonic bacteria resulting in the production of butyrate which is the primary energy source of colonocytes. Other short chain fatty acids (acetate and propionate) are also produced by the fermentation of fibre which helps to reduce colonic pH which in turn lessens the risk of colonisation by pathogenic bacteria. Absorption of short chain fatty acids increases the absorption of water and electrolytes in the colon. Non-fermentable fibres act as bulking agents and bind substances that may cause damage to the colonic mucosa such as bile acids, ammonia and fatty acids.

Occasionally commercial single (novel) protein diets may fail to result in an improvement in clinical signs. In such cases either a hydrolysed diet (such as Hill’s z/d) may be used or an elimination diet based on the use of a home prepared, single protein and carbohydrate source with nothing else added. In cats carbohydrates should not be included.
There is considerable debate at this time regarding the drug therapy that should be used in the treatment of IBD. There is some evidence to suggest that the immune response seen in IBD is not associated with pathogens but is a response to the normal gut flora. The immune response may be modulated using drugs such as prednisolone, sulphasalazine or azathioprine. However in a number of cases these drugs fail to affect a response. Alternatively antibacterial agents such as tylosin, metronidazole or in the case of Boxers with histiocytic colitis enrofloxacin have been used. There are several reports of colonic IBD responding to antibacterials more effectively than to anti-inflammatory agents. Therefore at this time it is difficult to offer a precise protocol. Where clinical signs are not severe the use of antibacterial agents may be tried and if these fail anti-inflammatory agents may be added to the treatment regime. For small intestinal diarrhoea prednisolone is the anti-inflammatory drug of choice whilst sulphasalazine remains the drug of choice where large intestinal IBD exists.

Protein-losing enteropathy (PLE)

There are several causes of PLE (Table 5) and it should be noted that not all dogs with PLE present with diarrhoea but may instead present for clinical signs associated with hypoproteinaemia. Confirming the underlying cause of the PLE is essential so an accurate prognosis can be given and the most appropriate treatment started. IBD and lymphangiectasia are the commonest causes of PLE in dogs. In these cases the diet should be high in protein and low in fat. This is best achieved by using a single protein diet or low fat diets with added low fat cottage cheese. This should be fed to the exclusion of all other foods. In addition most patients benefit from treatment with prednisolone or azathioprine aimed at reducing the level of inflammation present. There is evidence to suggest that patients with PLE benefit from intravenous administration of colloids at the same time as starting dietary and drug therapies. This helps restore oncotic pressure, reducing oedema of the bowel and further fluid and protein loss.

There are no good prognostic indicators for PLE at present so the prognosis must always be guarded and it remains unclear why some animals respond better to treatment than others. Where neoplasia is the cause of PLE the prognosis must clearly be very guarded. Dogs with intestinal lymphoma do not respond well to chemotherapy although the response in cats appears to be better. Adenocarcinoma, if detected early may respond well to surgical intervention but in most cases is diagnosed too late for a successful outcome.

**Antibiotic-responsive diarrhoea**

Management of ARD is probably best achieved using a diet low in fat given together with antibiotics. The antibiotic of choice in these cases is tylosin or oxytetracycline. Some dogs need only a short course of antibiotics whereas others require long term medication to prevent recurrence of clinical signs. Recent interest has centred around the use of prebiotics such as FOS in the long-term management of this condition and also on the possible role of probiotics in treatment. Further research is required in this area.

**Exocrine pancreatic insufficiency**

Treatment of EPI is centred around diet and supplementation with pancreatic enzymes. Powdered enzyme preparations have proved more efficacious than enteric coated tablets. Pancreatic enzyme supplementation alone will result in resolution of clinical signs in approximately half of affected dogs. However a highly digestible, low fibre, low fat diet will be required in addition to enzyme supplementation in the remaining cases. It is important for successful resolution of clinical signs to stage the treatment in the following manner. Feed a low fat diet at a rate appropriate for the dog’s present body weight. To this add an appropriate level of enzyme supplement. This will normally resolve the diarrhoea within 48 hours. Once this has been achieved the amount of diet and enzyme supplement should be increased to achieve weight gain. Only once the dog has returned to its ideal body weight will polyphagia cease. At this stage the amount of diet fed and enzyme supplementation used can often be reduced. Over supplementation of the diet with pancreatic enzymes should be avoided as this can cause flatulence and worsen diarrhoea.

ARD is common in dogs with EPI due to the increased nutrient load in the intestinal environment. Where dogs respond poorly to treatment with diet and pancreatic enzymes, antibiotic treatment with tylosin or metronidazole should be considered. Cobalamin deficiency is more
common in cats than dogs. This may be due to the fact that the only source of intrinsic factor in cats is the pancreas whereas intrinsic factor is also produced in the stomach of dogs. Monitoring of serum cobalamin levels and parenteral supplementation when necessary is recommended in both species. The use of H2-antagonists to increase gastric pH and reduce the gastric destruction of pancreatic enzymes is controversial and unnecessary in most cases. Approximately 70% of dogs will respond to treatment, while the cause of treatment failure in the remaining cases is not fully understood.

Irritable bowel syndrome (IBS)

This is a difficult disorder to diagnose as there is no definitive test available; a diagnosis can only be made by excluding all other causes of chronic diarrhoea. IBS cases present with a history of bouts of abdominal pain and chronic large intestinal diarrhoea, which are interspersed with periods free of clinical signs or occasionally constipation. Most cases are seen in working dogs where clinical signs can often be reversed simply by staggering or reducing their work load. It is likely to occur in other dogs but stress triggers in those cases are difficult to identify. Where IBS is suspected initial treatment involves identification and elimination of known stressful events that can be associated with the onset of clinical signs together with feeding a high fibre diet. In many dogs, adding fibre to the diet will result in a reduction in the severity and frequency of clinical signs but acute episodes may still occur and at these times motility modification may be helpful in controlling clinical signs.

Where diarrhoea is the predominant clinical sign, a short course (several days to two weeks) of loperamide (Imodium) may be helpful. Dogs with intestinal spasm, constipation and abdominal pain may benefit from drugs such as mebeverine hydrochloride (Colofac) or hyoscine (Buscopan). Mebeverine hydrochloride, a direct acting smooth muscle relaxant has local anaesthetic properties and mild anticholinergic effects. Its use in dogs has not been widely reported and little is known about its side-effects but it does appear to be useful in managing idiopathic motility disorders in some individuals. Simethicone is an inert non-absorbed defoaming agent that coalesces gas bubbles in the gastrointestinal tract. This drug may be beneficial in dogs with increased gastrointestinal gas and pain.

SUMMARY

Acute diarrhoea can often be successfully managed using supportive therapy. Effective management of chronic diarrhoea is dependent on investigation of the underlying aetiology. Dogs with chronic diarrhoea have compromised intestinal health and may be at increased risk of colonisation by pathogenic bacteria. Owners should be advised that many causes of chronic diarrhoea will require long term management, and regular contact with the owner is essential in order to find out which management plan works best for each individual animal.

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Small Animal Gastroenterology 3rd Edition: Editors Strombeck, D. R. Guilford, W. G.; Chapters 17, 18 and 24.
1. Diets used in the symptomatic management of acute diarrhoea should be:
   a. moderately fat restricted, high fibre
   b. high fat, high fibre
   c. moderately fat restricted, low fibre
   d. high fat, high protein

2. Loperamide and diphenoxylate are opiate motility modifying drugs used in the management of diarrhoea because they:
   a. increase segmental and reduce peristaltic contractility
   b. reduce segmental and increase peristaltic contractility
   c. increase segmental and peristaltic contractility
   d. reduce segmental and peristaltic contractility

3. A suitable diet for dogs with small intestinal IBD contains:
   a. high protein levels and reduced fat
   b. high fibre, high fat diet.
   c. single (novel) protein source and high fibre
   d. single (novel) protein source and reduced fat

4. Fermentable fibre:
   a. acts as a bulking agent
   b. is digested in the colon to produce short chain fatty acids
   c. is digested in the small intestine to produce short chain fatty acids
   d. passes through the intestinal tract unchanged

5. What percentage of dogs with exocrine pancreatic insufficiency show an adequate response to medical management:
   a. 50%
   b. 60%
   c. 70%
   d. 80%