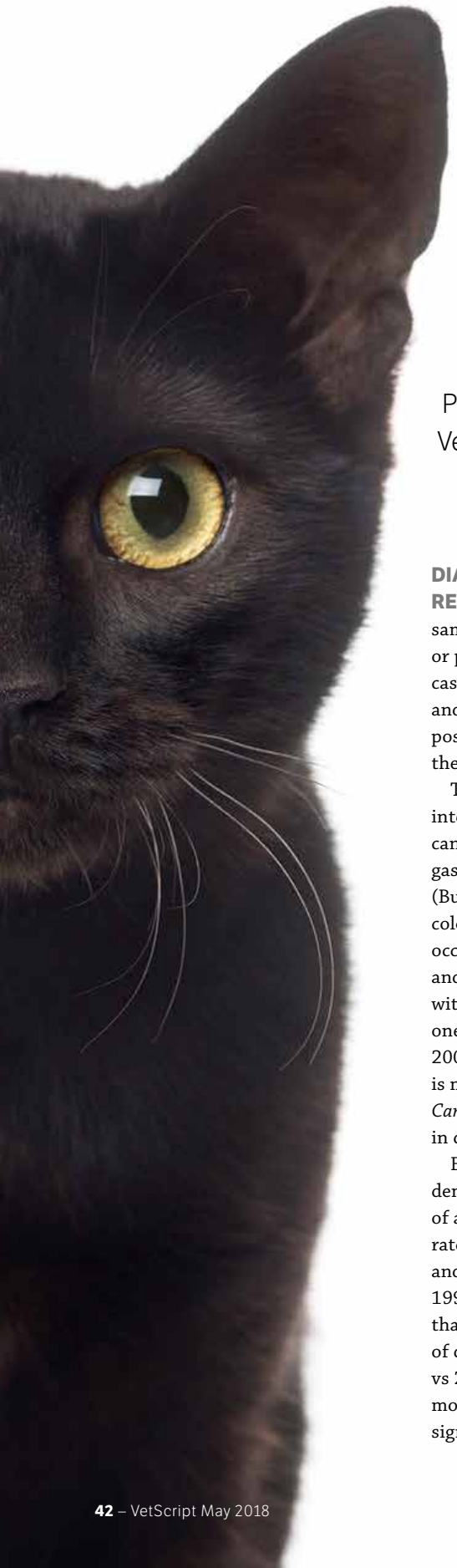

Campylobacter culture in cats and dogs – money well spent?

Pathologist **Geoff Orbell**, Veterinary Clinical Director of Gribbles Veterinary, Palmerston North, outlines some of the considerations of a positive *Campylobacter* culture result.

DIAGNOSTIC LABORATORIES RECEIVE a significant number of samples requesting *Campylobacter* culture or polymerase chain reaction (PCR) for cases of gastrointestinal disease in dogs and cats. Frequently these cases will be positive, which requires interpretation by the veterinary pathologist and clinician.

The biggest problem with interpretation is that *Campylobacter* can be a normal commensal of the gastrointestinal tract in cats and dogs (Burnens et al., 1992; Weese, 2011) with colonisation of the gastrointestinal tract occurring as early as 11 weeks in kittens and puppies (Hald and Madsen, 1997) with 87% to 100% of dogs colonised by one year. (Marks et al., 2011; Hald et al., 2004). In cats, *Campylobacter helveticus* is most frequently isolated, with *Campylobacter upsaliensis* predominating in dogs (Marks et al., 2011).

Early studies using traditional culture demonstrated that in dogs >12 months of age there was no difference in isolation rates of *Campylobacter* between healthy and diarrhoeic animals (Burnens et al., 1992). However, the same study showed that in dogs <12 months of age, 44% of diarrhoeic dogs shed *Campylobacter* vs 21% of healthy dogs. More recent molecular studies failed to demonstrate a significant difference in the identification of *Campylobacter* from healthy or diarrhoeic dogs (Suchodolski et al., 2010), although one quantitative study (Chaban et al., 2010) demonstrated significantly increased numbers of *Campylobacter* in diarrhoeic dogs.

Although the first study is suggestive of a role of *Campylobacter* in enteric disease of younger dogs, increased isolation from clinical cases does not define causality. It has been increasingly shown in domestic species (Barko et al., 2018; Suchodolski 2016) and humans (Singh et al., 2017) that changes in the intestinal microbiome can occur secondary to other conditions/diseases. In some cases, dysbiosis can lead to pathological changes which could rightly or wrongly be solely ascribed to proliferation of an organism that otherwise may have been considered commensal. This has been shown in one molecular study where there was a significant increase in the number and species of *Campylobacter* in diarrhoeic dogs regardless of the primary cause (Chaban et al., 2010). This has also been demonstrated in pigs with enteric proliferation of *Campylobacter* secondary to swine dysentery (Quin et al., 1994).

A carrier state of pathogenic *Campylobacter* in asymptomatic humans is rare in the industrialised world (Leedom-Lareson at al., 2012), therefore

PHOTOGRAPHY: 123RF.COM

the isolation of *Campylobacter* from diarrhoeic samples is most likely to be significant. *Campylobacter jejuni* and *Campylobacter coli* are most frequently isolated in humans, and usually this is associated with improperly cooked meat (especially poultry products), raw milk consumption or water contamination (Janssen et al., 2008). Some studies have demonstrated an increased risk associated with pet ownership, with identical strains of *Campylobacter jejuni* or *Campylobacter coli* identified in owners and their pets (Gras et al., 2013). *Campylobacter upsaliensis* has also been recently recognised as a pathogen in humans with dogs and cats as the main reservoir for infection (Kaakoush et al., 2015; Bojanić et al., 2017).

The other problem with interpretation of positive culture results in cats and dogs is that diagnostic criteria for enteric campylobacteriosis are not well defined, with few reportedly confirmed cases of natural infection (Brown et al., 1999; Fox et al., 1983) and variable results from experimental infections (Brown et al., 1999; Macartney 1988; Olson and Sandstedt, 1987), with mild diarrhoea in puppies from one study.

In humans, clinical disease is associated with either enterocyte adhesion and toxin production with a secretory diarrhoea or invasion of enterocytes and inflammatory disease (Janssen et al., 2008). To date only one study of natural infection in dogs (Brown et al., 1999) has immunohistochemical identification of *Campylobacter* associated with intestinal pathology, but the organisms identified were located within crypt lumens of the small and large intestines rather than adherent to or within enterocytes. Another study in cats was more convincing where fluorescent in situ hybridisation (FISH) was used to demonstrate *Campylobacter coli* associated with neutrophilic, mucosal inflammatory bowel disease in intestinal biopsies (Maunder et al., 2016).

Reported clinical signs of campylobacteriosis in dogs are variable and non-specific and range from mild, loose faeces to watery diarrhoea or bloody mucoid diarrhoea. Acute campylobacteriosis can reportedly be accompanied by anorexia, intermittent vomiting and fever (Marks et al., 2011). The majority of cases are self-limiting and will resolve with supportive therapy alone. Antimicrobial treatment is only indicated in febrile or immunocompromised animals or cases with haemorrhagic diarrhoea, otherwise the intestinal microflora may be disrupted (Marks et al., 2011). Antimicrobial therapy may also be indicated where there are extra-intestinal infections, or where exposure of infected pets to high-risk individuals of a household is unavoidable – for example, children or immunocompromised individuals.

In humans, up to 40% of cases of Guillain-Barré syndrome (progressive immune-mediated myelinopathy/axonopathy) have been associated with *Campylobacter jejuni* infection one to two weeks prior. This is believed to be due to molecular mimicry, and a cross-reactive cell mediated and humoral immune response that results in antiganglioside antibodies, complement activation and targeting of myelin sheaths and axonal degeneration. (Nyati and Nyati, 2013).

THE BIGGEST PROBLEM WITH INTERPRETATION IS THAT *CAMPYLOBACTER* CAN BE A **NORMAL COMMENSAL OF THE GASTROINTESTINAL TRACT IN CATS AND DOGS.**

Similarly, this year a study (Martinez-Anton et al., 2018) found an association with acute polyradiculoneuritis (APN) in dogs, *Campylobacter* spp and raw chicken consumption. Dogs with APN were significantly more likely to be positive for *Campylobacter* spp compared to control dogs. Significantly more APN cases (96%) were associated with the consumption of raw chicken, as opposed to 26% of control dogs. However, in this case the most common species identified was *Campylobacter upsaliensis*, which is less commonly carried in the gastrointestinal tracts of chickens (up to 9.7%), but is the most common *Campylobacter* isolated in dogs (Marks et al., 2011).

In summary, despite the advent of more sensitive molecular testing for *Campylobacter* spp in dogs and cats, strong evidence of clinical enteric campylobacteriosis is still lacking. *Campylobacter* are frequently isolated from healthy and diarrhoeic dogs and cats of all ages, therefore subclinical infections or carrier status are common.

In contrast to humans, no studies in dogs or cats have conclusively demonstrated pathogenicity of *Campylobacter* spp. Additionally, no specific clinical picture or diagnostic criteria have been established for campylobacteriosis in dogs and cats. Therefore, it should be considered a diagnosis of exclusion when identified on faecal culture or by PCR.

Based on the limited evidence thus far, if *Campylobacter* are pathogenic in dogs and cats, then animals <6 months of age in stressed or crowded conditions are most likely to be affected acutely with mild, non-specific clinical signs, which will likely resolve clinically without treatment. Therefore, submission of faecal samples for *Campylobacter* culture or PCR in adult dogs or cats with signs of diarrhoea or chronic gastrointestinal disease is not needed in the majority of cases.

Potentially, the most significance that can currently be ascribed to positive faecal culture or PCR in diarrhoeic dogs and cats is the zoonotic potential of *Campylobacter jejuni*, *Campylobacter coli* and *Campylobacter upsaliensis* when identified, especially in a houseold with young children or immunosuppressed individuals. VS

REFERENCES:

Barko PC, McMichael MA, Swanson KS, Williams DA. The gastrointestinal microbiome: a review. *Journal of Veterinary Internal Medicine*, 32(1), 9–25, 2018

Bojanić K, Midwinter A, Biggs P, Acke E. Canine infectious diarrhoea: *Campylobacter*, a conundrum in dogs. *Proceedings of the Annual Seminars of the Companion Animal Society of the NZVA*, Pp 95–104, 2014

Bojanić K, Midwinter AC, Marshall JC, Rogers LE, Biggs PJ, Acke E. Isolation of *Campylobacter* spp. from client-owned dogs and cats, and retail raw meat pet food in the Manawatu, New Zealand. *Zoonoses and Public Health* 64, 438–49, 2017

Brown C, Martin V, Chitwood S. An outbreak of enterocolitis due to *Campylobacter* spp. in a beagle colony. *Journal of Veterinary Diagnostic Investigation* 11(4), 374–6, 1999

Burnens AP, Angéloz-Wick B, Nicolet J. Comparison of *Campylobacter* carriage rates in diarrheic and healthy pet animals. *Zoonoses and Public Health* 39(3), 175–80, 1992

Chaban B, Ngeleka M, Hill JE. Detection and quantification of 14 *Campylobacter* species in pet dogs reveals an increase in species richness in faeces of diarrheic animals. *BMC Microbiology* 10, 73–9, 2010

Fox JG, Moore R, Ackerman JI. *Campylobacter jejuni*-associated diarrhea in dogs. *Journal of the American Veterinary Medical Association* 183, 1430–3, 1983

Gras LM, Smid JH, Wagenaar JA, Koene MG, Havelaar AH, Friesema IH, French NP, Flemming C, Galson JD, Graziani C, Busani L, van Pelt W. Increased risk for *Campylobacter jejuni* and *C coli* infection of pet origin in dog owners and evidence for genetic association between strains causing infection in humans and their pets. *Epidemiology and Infection* 28, 1–10, 2013

Hald B, Madsen M. Healthy puppies and kittens as carriers of *Campylobacter* spp., with special reference to *Campylobacter upsaliensis*. *Journal of Clinical Microbiology* 35 (12), 3351–2, 1997

Hald B, Pedersen K, Waino M, Jorgensen JC, Madsen M. Longitudinal study of the excretion patterns of thermophilic *Campylobacter* spp. in young pet dogs in Denmark. *Journal of Clinical Microbiology* 42, 2003–12, 2004

Janssen R, Krogfelt KA, Cawthraw SA, van Pelt W, Wagenaar JA, Owen RJ. Host-pathogen interactions in *Campylobacter* infections: the host perspective. *Clinical Microbiology Reviews* 21(3), 505–18, 2008

Kaakoush NO, Castano-Rodriguez N, Mitchell HM, Man SM. Global Epidemiology of *Campylobacter* infection. *Clinical Microbiology Reviews* 28, 687–720, 2015

Leedom-Larson KR, Spickler AR. *Campylobacteriosis*. Zoonotic *campylobacteriosis*. Center of Food Security and Public Health factsheet, Iowa State University, 2013

Macartney L, Al-Mashat RR, Taylor DJ, McCandish IA. Experimental infection of dogs with *Campylobacter jejuni*. *Veterinary Record* 122, 245–9, 1988

Marks SL, Rankin SC, Byrne BA, Weese JS. Enteropathogenic bacteria in dogs and cats: diagnosis, epidemiology, treatment, and control. *Journal of Veterinary Internal Medicine* 25(6), 1195–208, 2011

Martinez-Anton L, Marenda M, Firestone SM, Bushell RN, Child G, Hamilton AI, Long SN, Le Chevoir MAR. Investigation of the role of *Campylobacter* infection in suspected acute polyradiculoneuritis in dogs. *Journal of Veterinary Internal Medicine* 32(10, 352–360, 2018

Maunder CL, Reynolds ZF, Peacock L, Hall EJ, Day MJ, Cogan TA. *Campylobacter* species and neutrophilic inflammatory bowel disease in cats. *Journal of Veterinary Internal Medicine* 30, 996–1001, 2016

Nyati KK, Nyati R. Role of *Campylobacter jejuni* infection in the pathogenesis of Guillain-Barré syndrome: an update. *Biomed Research International*, 2013

Olson P, Sandstedt K. *Campylobacter* in the dog: a clinical and experimental study. *Veterinary Record* 121, 99–101, 1987

Prescott JF, Karmali MA. Attempts to transmit *Campylobacter enteritis* to dogs and cats. *Canadian Medical Association Journal* 119, 1001–2, 1978

Quin PJ, Carter ME, Markey BK, Carter GR. *Campylobacter* species. In: *Clinical Veterinary Microbiology* 1st Edition. London Book Europe Limited. Pp 268–72, 1994

Singh RK, Chang HW, Yan D, Lee KM, Ucmak D, Wong K, Abrouk M, Farahnik B, Nakamura M, Zhu TH, Bhutani T, Liao W. Influence of diet on the gut microbiome and implications for human health. *Journal of Translational Medicine* 15 (73), 2017

Suchodolski JS. Diagnosis and interpretation of intestinal dysbiosis in dogs and cats. *Veterinary Journal* 215, 30–7, 2016

Suchodolski JS, Gossett NM, Aicher KM, Heilmann RM, Xenoulis PG, Steiner JM. Molecular assay for the detection of *Campylobacter* spp in canine and feline fecal samples. *Journal of Veterinary Internal Medicine* 24, 748–9, 2010

Volkmann M, Steiner JM, Fosgate GT, Zentek J, Hartmann S, Kohn B. Chronic diarrhea in dogs: retrospective study in 136 cases. *Journal of Veterinary Internal Medicine* 31(4), 1043–55, 2017

Weese JS. Bacterial enteritis in dogs and cats: diagnosis, therapy, and zoonotic potential. *Veterinary Clinics of North America Small Animal Practice* 41(2), 287–309, 2011