Australian ECC Year In Review

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1. Introduction

In keeping with our Australian ECC Year in Review sessions of previous ANZCVS Science Week conferences, we have each chosen 5 articles to present, based on a search of the table of contents of the Australian Veterinary Journal and New Zealand Veterinary Journal, as well as a PubMed search using the terms “snake envenomation” and “tick paralysis”.

1.1 Characteristics and outcome of 73 dogs with iron EDTA molluscicide ingestion in Melbourne, Australia (2013–2019)

Lauinger, Wright, and Smart performed a retrospective observational study to report clinical features of iron EDTA molluscicide toxicosis in dogs, and to determine if any features were associated with a serum iron concentration above the generally-accepted toxic level of 54 µmol/L.[1] Cases were identified from a medical record search of four 24-h emergency hospitals between 2013-2019. Clinical information included history, clinical signs on examination, clinicopathologic abnormalities including serum iron concentration, therapy provided including deferoxamine chelation, the presence or absence of urine discolouration, duration of hospitalisation, and survival. 73 dogs were included. Clinical signs were varied, but predominantly were gastrointestinal in nature. Metabolic acidosis was uncommon, which was unexpected given the association with iron toxicosis in human medicine. Of the 48 dogs that had baseline serum iron concentration, 35 were above 54 µmol/L. However, all subsequent iron concentration measurements were below this threshold, regardless of whether chelation was provided and the duration of chelation. The presence of abnormal faeces on examination was associated with serum iron > 54 µmol/L. Sixty dogs were hospitalised and 54 were treated with deferoxamine. There was an association between finding discoloured urine during hospitalisation and an initial serum iron > 54 µmol/L. Most dogs survived, with 59 being discharged home, 10 transferred to the family veterinarian, and four euthanised.

1.2 Signalment, clinical characteristics and outcomes of an Australian population of dogs with steroid responsive meningitis-arteritis (SRMA)– 124 cases (2013–2023)

Paterson and Brady performed a historical case series of dogs with SRMA across 5 Australian referral hospitals.[2] There is a lack of previous Australian publications on this disease, and this study aimed to determine if there are local differences in breed predisposition, clinical characteristics, or outcomes. A total of 124 dogs were included. Italian greyhounds and Australian kelpies were newly reported breeds in this study. Cavoodles were common in this

study, but it is unknown if that is due to a true breed predisposition or simply reflects the local popularity of the breed. Clinical features were similar to previous reports, with most dogs presenting with pain, fever, and laboratory evidence of inflammation, but a low frequency of neurological signs. Outcomes were generally good, with the frequency of relapses in line with previous reports. Relapse was more common in female dogs, Italian greyhounds, and corgis.

1.3 Severe oesophagitis and oesophageal stricture secondary to anaphylaxis in a dog

This case report details a previously unreported complication in a dog.[3] A 9-month-old Brussels griffon sustained a severe anaphylactic reaction after exposure to *Hymenoptera*. An adrenaline infusion was needed for 48 hours to maintain normotension. Haematemesis and regurgitation were early features of the presentation, as are commonly seen in canine anaphylaxis. However, there was persistence of vomiting and regurgitation though the first week of hospitalisation, prompting oesophagoscopy that identified evidence of oesophagitis. In the subsequent days percutaneous endoscopic tube gastrostomy was performed to allow for direct gastric feeding and oesophageal rest. Despite this, there was development of an oesophageal stricture (diagnosed on endoscopy and fluoroscopy) that required four weekly oesophageal balloon dilation treatments. This complication of anaphylaxis is novel, but is understandable given the combination of upper gastrointestinal signs and reduced perfusion caused by anaphylaxis.

1.4 Categorising reported errors and incidents from morbidity and mortality meetings (M&Ms) in a small animal multi-specialty veterinary teaching hospital

Giles *et al* presented a retrospective analysis of patient safety events presented through their university teaching hospital's morbidity and mortality rounds, which were part of a patient safety incident reporting system.[4] They used an accepted system to classify the events into eight categories: drug, iatrogenic system, communication, labs, oversight, staff, or equipment. This system was used to classify both primary causative errors and secondary errors, where applicable, for each reported incident. The severity of harm resulting from each incident was also categorised as no harm detected, temporary harm, permanent harm, death, or euthanasia. Incident types were also classified as near miss, harmless hit, adverse incident, or unsafe condition. Recommendations arising from each incident were also coded and reported. A total of 68 cases (38 dogs, 27 cats, 3 species not listed) were analysed. Oversight errors were most common, followed by drug, iatrogenic, and staff errors. Most were adverse incidents, and near misses or unsafe conditions were rarely reported, which may reflect underreporting in their voluntary system. Most errors resulted in temporary harm or no harm, though there were 14 cases with permanent harm, death, or euthanasia. The most frequent recommendations were for improving communication/record keeping, improving staff training, ensuring appropriate equipment is available, and no recommendations made. This represents the largest published study of patient safety incidents in veterinary medicine, and the first to report an analysis of error type and severity. Whilst it is currently unknown whether the specific findings from this referral institution are broadly generalisable, the described systems are valuable for others looking to institute such a system in their own hospital.

1.5 Prospective study of 506 dogs with tick paralysis: investigating measures of severity and clinical signs as predictors of mortality and assessing the benefits of different therapeutics

Atwell and Vankan published a large prospective observational study in a cohort of dogs treated in primary care practice for tick paralysis, investigating predictors of mortality and benefits of various treatments.[5] This large study enlisted 42 primary care practices throughout the eastern seaboard to enrol up to 15 dogs each, over the course of a single tick season. A large number of potential predictors of mortality were assessed. As well as conventional clinical signs and established scores, this study also included some novel potential measures of severity. These included visual analogue scales for overall severity, respiratory dysfunction, and the degree of paresis/paralysis, as well as assessment of facial expressions. Associations between mortality and the use of tick antiserum and various other supportive treatments were also assessed. A total of 506 dogs were enrolled. The incidence of mortality was 6.1% (31 dogs) with most (28 dogs) being natural death rather than euthanasia. Age was the only animal or tick factor associated with mortality, with dogs older than 7 years having the greatest risk of death. The traditional gait score and all three visual analogue scales showed some association with mortality, although the respiratory visual analogue scale appeared to perform best of the three. Most individual respiratory signs did not show strong associations with mortality, except for inspiratory dyspnoea and crackles at presentation, and expiratory dyspnoea and expiratory wheeze on day 2. Facial expressions of anxiety, glazed eyes, and fatigue were all predictive or mortality. Tick antiserum was protective against mortality, whilst few associations were found for other treatments except in severe cases. The large sample size and high proportion of non-survivors suffering natural death add strength to this study as a robust description of predictors of mortality. As none of the included practiced had access to intensive care facilities, it is unknown whether some of the non-survivors could have survived with intensive care. Thus, further research is required to determine predictors of mortality in an emergency and critical care referral setting. However, this study may aid general practitioners in the identification of cases that are appropriate to refer.

1.6 Retrospective assessment of ophthalmic disease development in domestic dogs and cats when hospitalised with tick paralysis caused by *Ixodes holocyclus*

Continuing on the topic of tick paralysis, Dr Reynolds and colleagues have published two papers in the last 12 months evaluation the development of ophthalmic disease in dogs and cats hospitalised with tick paralysis.[6] Despite it being well known that dogs and cats with tick paralysis are at risk of corneal ulcers and the recommendation for frequent ocular lubrication, the degree of ophthalmic pathology and frequency of it occurring dogs and cats has never been specifically evaluated. The objective of this retrospective cohort study was to investigate the incidence and predisposing factors leading to the development of corneal ulcers and the loss of a palpebral reflex in dogs and cats hospitalised with tick paralysis. Cases seen at Northside Emergency Veterinary Service in Sydney from October 2020 to January 2022 were identified through an RxWorks search for ‘tick paralysis’. Hospital policy is for eye lubrication every 1-6 hours based on severity, with liquid paraffin and wool fat (Polyvisc, Alcon Laboratories, Australia). All cases undergo daily ocular examination by an emergency veterinarian including corneal fluorescein staining and palpebral reflex testing. Animals with chronic ophthalmic disease were excluded. Logistic regression was performed

to assess for associations with the presence / development of corneal ulcers and loss of palpebral.

Corneal ulcers were detected in 23/102 (22.5%) dogs after an average of 1.7 days of hospitalisation. Ulcers were strongly associated with an incomplete palpebral reflex ipsilaterally during hospitalisation (OR 14.7, P < 0.001), hospitalisation ≥3 days (P = 0.004), mechanical ventilation ≥3 days (P = 0.015), and a tick location cranial to C1 (OR 11.05 [95% CI 2.33–52.37], P = 0.003). There was a significant association between the loss of a complete palpebral reflex and mortality during hospitalisation in dogs (OR = 4.5, P = 0.029), which was not surprising given that it was also associated with the highest tick paralysis severity scoring.

Corneal ulcers were detected in 10/100 (10%) cats on average after 1.3 days of hospitalisation. Ulcers were significantly more likely to occur to an eye if an incomplete palpebral reflex was observed ipsilaterally during hospitalisation (OR = 20.1, P < 0.0001) and with increasing cat age (P = 0.019), but there was no significant association between the loss of a complete palpebral reflex and mortality during hospitalisation in cats.

1.7 Ophthalmic findings associated with Australian tick paralysis (holocyclotoxicity) in hospitalized domestic dogs and cats

The same group published another study in the Veterinary Ophthalmology journal with a different group of cases included from October 2021 to January 2022.[7] The second study had the same aim, but instead included cases examined by an ophthalmology resident. A non-dilated ophthalmic examination was performed, including slit lamp biomicroscopy, indirect ophthalmoscopy, Schirmer tear test-1 (STT-1), corneal fluorescein staining, and a neuro-ophthalmic examination. Tonometry was not performed. No ophthalmic medications or lubricants were applied to the eyes for a minimum of 4 h prior to the ophthalmic examination but the eyes were otherwise lubricated frequently during hospitalisation. Dogs and cats with a gait grade of 4 or a respiratory grade of D (including those receiving mechanical ventilation) were not examined and not included, due to the stress of examination compromising their care. Cases were also excluded if they had systemic disease (eg. endocrinopathy, systemic hypertension) that may alter their ophthalmic examination.

94 eyes from 47 dogs were examined at a mean of 2.7 days (range = 1.0–11.0) of hospitalisation. Corneal ulcers were identified in 19/94 (20.2%) of eyes and 16/47 (34.8%) of dogs. The finding of a corneal ulcer was significantly positively correlated with an absent palpebral reflex (p < .04), days hospitalized (p < .001), gait grade (p = .017), and concurrent use of piperacillin/tazobactam (p = .023) – presumably for concurrent aspiration pneumonia. The authors describe how “dogs with ulcerative keratopathies typically had an axial to paraxial superficial horizontal band of absent corneal epithelium.” There was a high proportion of dogs with STT-1 findings of <10 mm/min [21/94 (22.3%) eyes and 13/47 (27.7%) dogs], but there was no correlation between STT-1 and the presence of a corneal ulcer. Fixed mydriasis was observed in 6/94 (6.4%) eyes and 3/47 (6.4%) dogs, and was correlated with concurrent use of medetomidine (p = .019). The absence of a complete palpebral reflex increased the odds of a concurrent corneal ulcer being present by 3.2 times

(p = .037). Other localized neuro-ophthalmic defects included ptosis (n = 2) and unilateral xeromycteria (n = 1).

56 eyes from 28 cats (56 eyes) were examined at a mean of 2.1 days (range = 1.0–6.0) of hospitalisation. Corneal ulcers were identified in 18/56 (32.1%) eyes and 12/28 (42.9%) cats. The finding of a corneal ulcer in cats was significantly positively correlated with respiratory paralysis grade (p = .041) and concurrent butorphanol use (p = .037). The nature of the ulcerative keratopathy in affected cats was similar to that in dogs. An even higher proportion of cats than dogs had low STT-1 findings of ≤10 mm/min [24/56 (42.9%) eyes, and 16/28 (57.1%) cats]. As in dogs there was no association between STT results and the presence of corneal ulceration. Fixed mydriasis was observed in 20/56 (35.7%) eyes in 10/28 (35.7%) cats, and was significantly associated with respiratory and gait paralysis scores. One cat each had unilateral ptosis and unilateral Horner's syndrome.

In their discussion the authors explained that the reason for decreased tear production may be multifactorial. They hypothesised that it could be directly related to the inhibitory effects of holocyclotoxin on acetylcholine since ACh is important in basal tear production via the parasympathetic nervous system. Additional factors that may have contributed and have been shown in other studies to reduce tear production in dogs include butorphanol sedation and simply illness requiring hospitalisation. In contrast the authors did not believe that fixed mydriasis in a proportion of cases was related to tick paralysis directly, but rather may have reflected sympathetic nervous systemic activation.

1.8 A retrospective analysis of clinical features, management and outcomes in dogs and cats with Eastern Brown Snake envenomation

Moving onto some publications on snake envenomation. The objectives of this retrospective study from the University of Queensland were to threefold; firstly, to describe the clinical signs, coagulation test results and treatment of dogs and cats in South East Queensland with eastern brown snake envenomation (EBSE), secondly to report the prevalence and recovery from venom induced consumptive coagulopathy (VICC) and clinical haemorrhage, and finally to determine associations with length of hospitalisation or survival.[8] Cases were identified with key word and billing code searches of the medical record system between October 2016 and October 2022. Numerous criteria were required for inclusion. VICC was defined as prolongation of any coagulation time (ACT, PT and/or aPTT) above the manufacturer provided reference interval. Bleeding severity was classified as fatal if it resulted in death, major if it resulted in anaemia (PCV < 35% dogs, < 25% cats) and/or prompted the use of blood products, and minor if anaemia did not occur.

338 cases met inclusion criteria including 240 dogs and 98 cats. Dogs most commonly presented in September / October (110, 45.8%), and cats most commonly in November/December (30, 30.6%). The most frequently observed clinical signs in dogs were lower motor neuron (LMN) signs (159, 66%), haemorrhage (72, 30%) and abnormal breathing (70, 29%). A greater proportion of cats had LMN signs (92, 94%), and abnormal breathing (55, 56%), but only a small number (5, 5%) had signs of haemorrhage on initial presentation. Hypothermia was another common finding in cats (51, 52%). Coagulation testing was performed commonly, and the vast majority of cases were classified as having VICC (209/226 dogs, 92%, and 81/88 cats, 92%). Of the dogs and cats that had repeated

coagulation testing performed, the median time to resolution of VICC was 24 hours. Fatal pulmonary haemorrhage was reported in eight dogs and two cats. Overall, 89% of dogs and 75% of cats survived to discharge. There is a lot of valuable information in this manuscript that aids in our understanding of EBSE.

1.9 Same story, different endings: clinical course and outcomes of two dogs treated differently for delayed fulminant pulmonary haemorrhage 20 h after eastern brown snake (*Pseudonaja textilis*) envenomation

This report presents the clinical course and outcomes of two dogs that were treated differently upon recognition of pulmonary haemorrhage secondary to ESBE induced VICC.[9] Despite the description of this as delayed pulmonary haemorrhage, it is likely that some haemorrhage occurred early after envenomation, but clinical signs didn't fulminate until later. The first dog, an 8.5kg Australian terrier, developed abnormalities on thoracic POCUS, anaemia, and haemoptysis, but experienced deterioration despite fresh whole blood administration and was euthanised. The second dog, a 35kg German shorthaired pointer, in the same backyard as the first case, developed moderate pleural effusion as well as pulmonary haemorrhage due to VICC, and respiratory distress in a similar timeframe. This dog however was rapidly transfused 2 units of fresh frozen plasma, followed by packed red blood cells and an autotransfusion, and survived. The authors suggest that the more rapid infusion of clotting factors in the second case likely contributed to a better outcome. Indeed, we would suggest that plasma transfusion is indicated at the first evidence of clinically significant haemorrhage in EBSE.

1.10 Para-aminopropiophenone toxicity in domestic dogs: a description of non-target toxicosis in Victoria, Australia: 13 dogs (2016–2023)[10]

In 2016 the veterinary community was notified of the commencement of use of PAPP as a bait for feral animals, the risk that this may pose to pets, and the use of new methylene blue (MB) as an antidote. Since then, cases of PAPP toxicosis have been described anecdotally but had not been reported in the literature until now. As such, the aim of this case series was to describe the clinical presentation of PAPP toxicosis in dogs, approach to management, and outcome. Cases were identified by key words searches of the electronic medical record systems from two specialist and emergency hospitals, and a primary care practice collocated one of the referral hospitals, in Victoria between 2016 and 2023. Dogs included were those with high clinical suspicion, and presumptive diagnosis, of PAPP toxicosis. 13 dogs were identified with this search strategy. The onset of clinical signs, where known to the owner, varied from <30 min to up to 3 h. Three dogs (3/13) were directly observed consuming unknown material before the onset of clinical signs. Acute collapse was the most common presenting complaint (10/13), with progression to cardiopulmonary arrest in two dogs shortly after presentation to the veterinary hospital. Seven dogs vomited prior to presentation, while three additional dogs had gastrointestinal decontamination performed (induction of emesis in two, gastric lavage in one). Only two dogs had yellow marker beads in their vomitus (these are included in some formulations of PAPP to aid in diagnosis). All dogs had grossly discoloured mucous membranes (brown, grey, cyanotic) and respiratory abnormalities. Seven dogs had methemoglobin (MetHb) measured (mean 52.6% [Min-Max: 3%–92%], RI: 0%–2%). Based on this, three dogs were classified as early PAPP toxicosis (MetHb <50%), and four dogs as mid-late toxicosis (MetHb >50%).

Initial treatment included oxygen supplementation and a dose of 1% MB IV. The mean initial dose of MB was 3.8 mg/kg IV (Min-Max: 1–7.5 mg/kg), and the mean total dose over a 24-h period was 5.3 mg/kg (Min-Max 1–9.5 mg/kg). Interestingly, this is lower than the initial MB dose recommended by the AVA (5 mg/kg IV titrated over 5 min diluted in D5W), with the maximum total dose not to exceed 10 mg/kg over 24 h to minimise risk the risk of erythrocyte injury and Heinz body haemolytic anaemia. No adverse effects of MB were recorded, and MetHb concentration decreased over time during MB treatment. 10 dogs survived to discharge, 2 died (as above), and one was euthanised. The mean duration of hospitalisation was 1.6 days.

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