



AUSTRALIAN TICK PARALYSIS OF DOGS AND CATS

A Guide to Diagnosis, Management, Treatment and Prevention

Developed by the Australian Tick Paralysis Advisory Panel, 2016
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CONTENTS

Introduction	1
Australian Paralysis Tick Advisory Panel Members 2016	2
Diagnostic Approach	4
Treatment Protocols	
Protocol A	
– No Clinical Signs of Tick Paralysis with Evidence of a Tick or Tick Crater	6
Protocol B	
– Clinical Signs of Tick Paralysis with or without Evidence of a Tick or Tick Crater	8
Management of the Complicated Patient	14
Feline Patients: The Differences	16
Tips for Transportation of Tick Paralysis Cases to Referral Centres	18
Tips for Brachycephalic Breeds	18
Managing Hypoventilation with Limited Veterinary Facilities	19
Intensive Care of the Anaesthetised and Intubated Patient	19

KEY
ACP – Acepromazine; BW – Body Weight; CRI – Continuous Rate Infusion; ET – Endotracheal; ETCO₂ – End-Tidal Carbon Dioxide; GA – General Anaesthesia; IM – Intramuscular; IV – Intravenous; IVDD – Intervertebral Disc Disease; LMN – Lower Motor Neuron; MSTs – Minimum Standards for Tick Search; NMJ – Neuromuscular Junction; PaO₂ – Arterial Partial Pressure of oxygen; PCO₂ – Partial Pressure of Carbon Dioxide (venous or arterial); SC – Subcutaneous; SpO₂ – Peripheral Capillary Oxygen Saturation; TAS – Tick Antitoxin Serum; THC – tetrahydrocannabinols; VAS – Visual Analogue Scale.

INTRODUCTION

The Australian Tick Paralysis Advisory Panel is an initiative supported by Merial Australia. The objective of the Panel's first meeting in April 2016 was to establish guidelines for the diagnostic approach, treatment, management and prevention of Australian Tick Paralysis of dogs and cats.

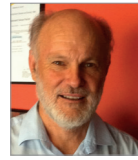
The resulting guidelines are documented in this booklet, and consist of information sourced from peer-reviewed publications, reported experiences, and expert opinions. In the absence of strong evidence, statements have been made based on the clinical expertise of the Panel.

It is anticipated that these guidelines will:

1. Provide a foundation for consistent management of Australian Tick Paralysis of dogs and cats
2. Deliver better outcomes for the patients and their owners
3. Assist veterinarians who are unfamiliar with treating Australian Tick Paralysis
4. Establish 'best practice' when managing Australian Tick Paralysis
5. Upgrade practice standards where applicable and appropriate



AUSTRALIAN PARALYSIS TICK ADVISORY PANEL MEMBERS 2016



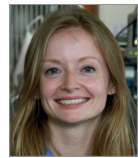
PROF RICK ATWELL

Rick graduated with first class honours in 1973, worked in general practice and then accepted a lectureship at School of Veterinary Science, University of Queensland. He proceeded to do a PhD in Pulmonary Hypertension, using canine heartworm disease as the model. He has been the Director of the University of Queensland Clinic and Hospital, and has had various roles within the Veterinary School, including Professorship and Head of the Medicine Department. His clinical speciality training was a Fellowship in Thoracic Medicine with the Australian College of Veterinary Scientists. Most of his clinical research work has been in Dirofilariosis and Holocyclototoxicosis and he has published over 200 papers and received several veterinary awards.



PROF STEPHEN BARKER

Stephen is a Professor of Parasitology in the Department of Parasitology, Faculty of Science, University of Queensland. Stephen has been studying ticks and other ectoparasites at the University of Queensland for 25 years. Recent activities include: (i) a monograph with Dr Allan Walker (University of Edinburgh) on the "Ticks of Australia. The species that infest domestic animals and humans" (2014, Zootaxa, 3816, 144 pp.); (ii) research on the paralysis ticks of Australia, *Ixodes holocyclus* (eastern paralysis tick) and *Ixodes cornuatus* (southern paralysis tick); and (iii) research on the evolution of the Boophilus ticks and the other hard ticks. Stephen offers a free tick-identification service to Australian veterinarians.



DR ERIN MOONEY

Dr Erin Mooney graduated with honours from the University of Sydney in 2007. Following graduation she undertook an internship in small animal medicine and surgery at a referral hospital in Connecticut, USA. This was followed by a residency in Small Animal Emergency and Critical Care (E/CC) at Tufts University in Massachusetts, a world-leading centre for E/CC training and clinical research. Erin became a Diplomate of the American College of Veterinary Emergency and Critical Care in 2012. Following her residency, Erin returned to Australia to work at the University of Melbourne. She later joined the Small Animal Specialist Hospital in Sydney as the city's first criticalist. Erin is currently working at the University of Sydney. Erin's clinical interests lie in pulmonary disease, mechanical ventilation, trauma, transfusion medicine, and peri-operative care.



DR ROB WEBSTER

Rob is a registered veterinary specialist in Emergency Medicine and Critical Care and a Director of the Animal Emergency Service. The practice has four hospitals in tick areas of South East Queensland, and treats over 2000 cases of tick paralysis annually. He developed an interest in managing severe tick paralysis early on in his career due to the high numbers of patients that tended to die despite 'appropriate' treatment. Rob has done clinical research into patients with tick paralysis and has several publications on the subject.



DR CHRISTOPHER HOLLAND

Christopher graduated with honours from the University of Sydney (1982) with BVSc, BSc(Vet). After 4 years in small animal practice he undertook a PhD in Neurophysiology at University of Sydney (1991) and continued postdoctoral research in this field at the universities of Cambridge (United Kingdom) and Newcastle (New South Wales). He has an interest in small animal neurology, particularly disorders of movement, cranial nerves and the autonomic nervous system, and has published a number of peer-review papers in this field.



DR VIBEKE RUSSELL

Vibeke graduated in 1996. She has worked in specialist hospitals since 1999 and as an emergency and critical care clinician since 2001. She is a Member of the Australian New Zealand College of Veterinary Scientists in Feline Medicine and Emergency Critical Care (ECC), and also completed a Masters of International Public Health. Vibeke has worked at SASH since it opened, but with a time break of a few years when she was working in hospitals in Melbourne. Her main interests are toxicity and envenomations, including snake and tick envenomations. Vibeke managed the ECC department at SASH, VetICU, from January 2013 until August 2016. She has recently moved to Tasmania, and is about to start a new position as Executive Director of the After Hours Veterinary Emergency Centre in Hobart.



DR TERRY KING

Terry graduated from the University of Queensland in 1975 (BVSc). In 1996 Terry became a Member of the Australian New Zealand College of Veterinary Scientists in Emergency and Critical Medicine. Terry spent 18 years in general practice, mostly small animal and three years in emergency practice before taking a position as Medical Clinician at the University of Queensland Veterinary Teaching Hospital in 1995. Since 2002 Terry has worked at Veterinary Specialist Services in South East Queensland looking after referral cases in small animal medicine and critical care.



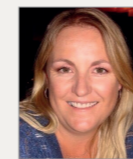
DR MICHAEL FITZGERALD

Michael graduated from the University of Sydney in 1983 after which time he worked in the United Kingdom for two years. Upon his return to Australia in 1985 Michael established Alstonville Veterinary Hospital in Northern New South Wales. In 1997 Michael became a Member of the Australian College of Veterinary Scientists by examination in Small Animal Medicine. He was also involved with research into tick paralysis treatment at the University of Queensland from 1998-2000.



DR HEATHER RUSSELL

Heather graduated with honours from Sydney University in 2002. She spent the first part of her career in the United Kingdom in small animal general practice where she completed a General Practitioner Certificate in Small Animal Medicine through the European School of Postgraduate Veterinary Studies. In 2011, she began working for Northside Emergency Vet Service (NEVS), and became Clinical Manager in mid-2015. NEVS is located on Sydney's Northern Beaches and treats over 1000 tick paralysis patients per year. On average, this practice mechanically ventilates over 40 patients per tick season.



DR ILZE NEL

Ilze graduated as a veterinarian from the University of Pretoria, Onderstepoort, South Africa in 1995. After graduation, she moved to the United Kingdom where she worked in companion animal general practice for nine years. In 2004 Ilze started working at a dedicated 24hr emergency care centre. Upon relocating to Australia in 2007 Ilze continued working in emergency and critical care, initially on the Gold Coast, then at the Small Animal Specialist Hospital in Sydney. During her time in Australia Ilze treated many cases of tick paralysis which has given her a great deal of insight into this disease. Ilze is currently the Boehringer Ingelheim Technical Services Veterinarian for New South Wales.



DR JAMIE MULCAHY

Jamie graduated from the University of Queensland in 1996 (BVSc Hons 1A). He started his career at the Mudgeeraba Animal Hospital (now Greencross Mudgeeraba) and is currently the Vet Director of Greencross Mudgeeraba. The hospital treats over 100 cases each tick season. This has driven his interest in the specifics of tick cases and their treatment.



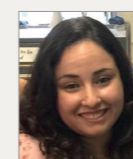
DR JUSTIN DANIEL

Justin graduated from Murdoch University in 1998. He worked in mixed animal practice in South Australia from 1999-2004, interrupted by a stint in the United Kingdom doing locum work in 2002. Justin moved to the New South Wales South Coast in 2005 to continue in rural mixed practice in a place where the ocean, national parks, snowy mountains and a hobby farm provide healthy outlets for work/life balance. Justin and his wife Lindy became the owners of Eden, Pambula and Merimbula Vet Clinics. These clinics see a large number of animals (large and small) with tick paralysis each year.



DR JENNIFER HAMILTON

Jennifer qualified as a veterinarian with honours from the University of Queensland in 2004, and after several years working within emergency and companion animal practice in Brisbane, she joined Merial to become a Field Services Veterinarian. In 2010 she became the Senior Technical Veterinarian, and has been the Technical Manager for the Companion Animal Business since 2013. Over the years, she has been closely involved with, and co-ordinated various tick-related initiatives including paralysis tick studies and industry educational projects. Her experience has given her insights into treating tick paralysis, the challenges faced by vets, students, nurses and pet owners with regards to this disease, as well as exposure to clinical study design and pharmacovigilance aspects of disease prevention and management.



MRS DAYANA BARKER

Dayana has a Bachelor of Biological Science and a Masters in Animal Science from the Federal University, Mato Grosso do Sul State (UFMS) in Brazil. Dayana has been studying *Ixodes cornuatus* and *Ixodes holocyclus*, for three years. Dayana has a particular interest in the paresis and paralysis caused by *I. cornuatus* and *I. holocyclus* in cats. Dayana now works in the Department of Parasitology at The University of Queensland and offers a free tick-identification service to Australian veterinarians.

DIAGNOSTIC APPROACH

Phone Advice to Client

HAS A TICK OR TICK CRATER BEEN FOUND ON THE ANIMAL?

NO: Search for ticks and tick craters (refer to Minimum Standards for Tick Search below)

YES: Remove ticks via a tick removal device, tweezers¹ or with fingers in a twist and pluck action. Retain ticks for identification by your veterinarian

IS THE ANIMAL SHOWING ANY CLINICAL SIGNS?

NO: Review of case details by veterinarian to decide approach, for example observation by owner as an outpatient versus consultation at clinic

YES: Seek veterinary attention urgently. In the meantime to manage the pet, advise client to:

- Withhold food and water
- Keep quiet, minimising stress and excitement
- Keep in a temperature controlled environment

Initial Approach

OBTAIN CLINICAL HISTORY

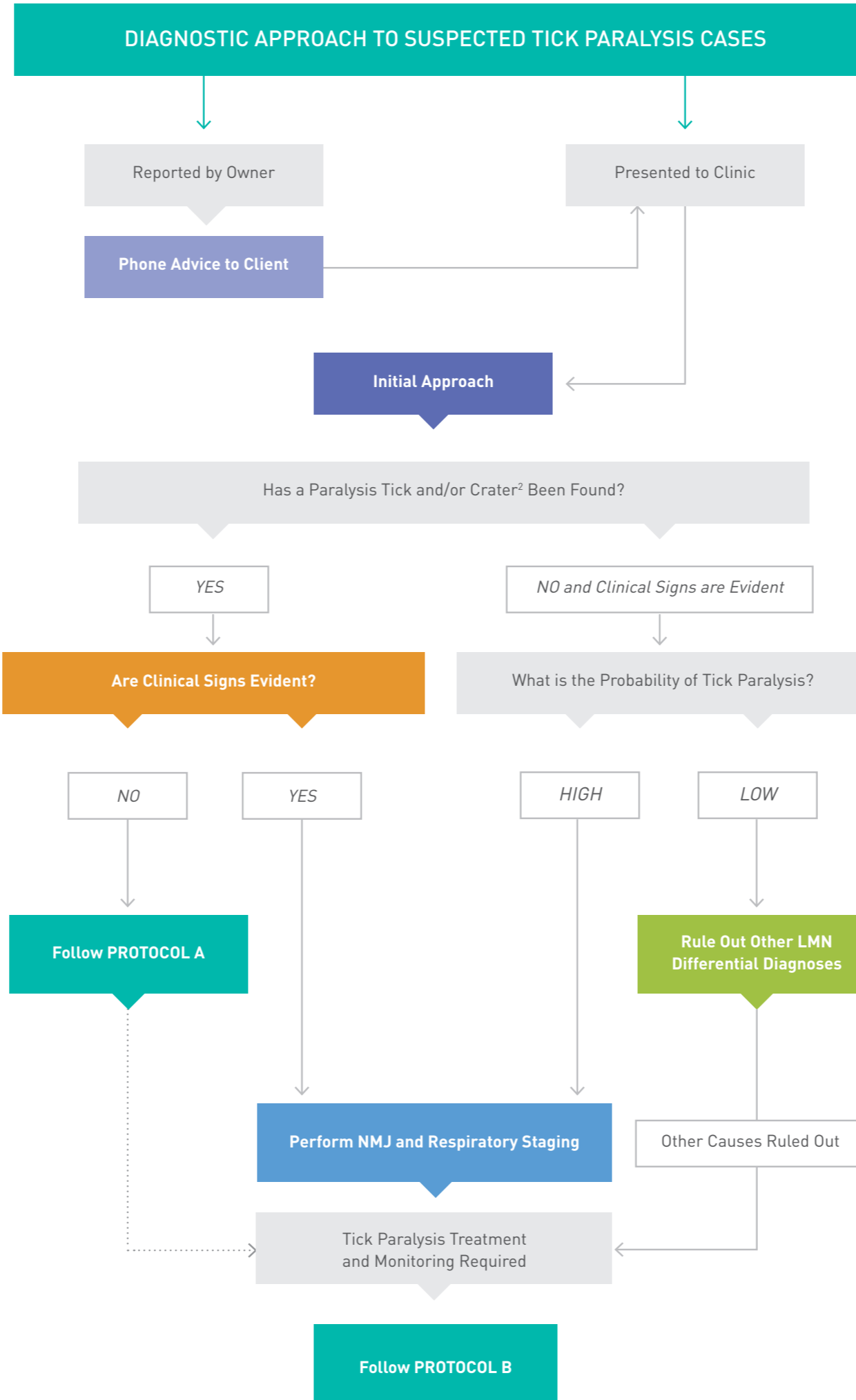
- Presence and time of onset of clinical signs
- Previous history of clinical tick paralysis and TAS treatment
- Details of tick preventative used and date of last dose
- Any concurrent disease(s)
- Exposure to tick habitats

PERFORM PHYSICAL AND NEUROLOGICAL EXAMINATIONS

- Take precautions to minimise stress at all times
- Respiratory examination to include auscultation of upper and lower respiratory tracts and careful assessment of the pharynx and larynx for dysfunction
- Assess gait and, if necessary, movements requiring increased neuromuscular effort (e.g. jumping up, hopping and figure of 8)²
- Assess for asymmetrical focal neurological deficits (e.g. anisocoria, reduced palpebral reflex, unilateral facial paralysis)³
- Perform corneal fluorescein staining¹²

MINIMUM STANDARDS FOR TICK SEARCH (MSTS)

- Search for ticks and tick craters²
 - Be systematic with the search pattern
 - Use the finger walking method⁴
 - Search the entire animal focussing on the head and neck^{2,4,5}
 - Ticks can be difficult to locate⁴ so remember to:
 - Search ear canals, lip margins, gums, hard palate, under collar, prepuce/vulva, rectum, tail tip, interdigital spaces and under dressings.
 - Look for asymmetric focal neurological deficits³
 - Initially, multiple searches (minimum of 3) need to be performed, ideally by different staff members
- Full body clip
 - To enhance retrieval of the entire tick burden⁶
 - Seek owner permission
 - Include the face, ears, paws and tail
 - Be aware that the stress of clipping can exacerbate respiratory dysfunction, even under sedation
 - Sedate if necessary
 - Acepromazine at 0.01-0.03 mg/kg IV, IM or SC; and/or
 - Butorphanol at 0.1-0.4 mg/kg IV, IM or SC
- If ticks are found, remove immediately^{2,7,8}
 - Use a tick removal device, tweezers¹ or fingers in a twist and pluck² action
 - Identify the ticks
- Always complete the full body search as multiple ticks can be attached^{7,8}
- During hospitalisation, and if not causing undue stress, perform tick searches² every 6-12 hours, for at least 48 hours after initial presentation



Clinical Signs

- Hind limb incoordination and paresis, progressing to paralysis
- Change or loss of voice
- Pupillary dilation²
- Dyspnoea
- Gagging, grunting or coughing
- Reduced palpebral reflex (may present with corneal ulcers³)
- Inspiratory stridor (may not be present with hypoventilation)⁷
- Inappetence
- Vomiting or regurgitation

LMN Differential Diagnosis

- Snake Envenomation
- Botulism
- Tetrodotoxin or Ciguatoxin Toxicity
- Polyneuropathy
- Acute Polyradiculoneuritis
- Chronic Organophosphate Toxicity
- Lasalocid/Monensin (Ionophore) Toxicity
- Recreational Drugs e.g. THC
- Prescription Drug Toxicity
- Canine Neural Angiostrongylosis
- Diffuse Myopathy/Polymyopathy
- Myasthenia Gravis
- Metabolic Disorders
- Fibrocartilagenous Embolism
- Spinal Disorders including IVDD

NMJ and Respiratory Staging

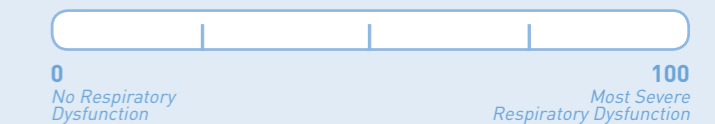
NMJ SCORE¹⁰

1	Mild weakness
2	Can stand but not walk
3	Cannot stand, but can right itself and maintain sternal recumbency
4	Unable to right itself, cannot maintain sternal recumbency

RESPIRATORY VAS SCORE

Clinical assessment of any respiratory dysfunction scored subjectively on a numerical rating scale between 0 and 100¹¹

VAS scores are then allocated into quartiles:
A = 0<25 , B = 25<50, C = 50<75, D = 75<100





TREATMENT PROTOCOLS

PROTOCOL A: NO CLINICAL SIGNS OF TICK PARALYSIS WITH EVIDENCE OF A TICK OR TICK CRATER

To be used in conjunction with *Diagnostic Approach*.

Treatment Considerations – A Risk: Benefit Approach

- Potential welfare, ethical and legal considerations include:
 - History and signalment
 - Likelihood of disease progression
 - Access to veterinary attention
 - Adverse systemic reactions to TAS
- Clinical signs usually appear⁴:
 - After 72 hours of attachment
 - With a tick size of 4 mm wide on the 4th day of attachment

Treatment Options

- Hospitalise for 24 hours for observation and tick search as per MSTs; or
- TAS treatment if:
 - High risk patient due to co-morbidity or age
 - Owner request
 - It is not feasible to admit the pet for monitoring or for the owner to return if clinical signs develop; or
- Close observation of patient by owner at home, with instructions to contact the veterinary clinic immediately if clinical signs develop

Preventative Treatment

- Administer acaricide to patient immediately if indicated
- Discuss ongoing prophylaxis for patient and all other at risk pets
- Considerations for prophylaxis selection:
 - Acaricidal label claims and speed of kill for *Ixodes holocyclus* vary with actives
 - Follow label instructions
 - Likelihood of owner compliance

Owner Vigilance

- Convey that signs of tick paralysis could still develop despite tick removal²
- Ongoing monitoring for clinical signs is necessary
- Keep quiet, minimise stress and excitement and consider confinement in a temperature controlled environment
- Perform tick searches (as per MSTs) every 6-12 hours for at least the following 72 hours
- Under veterinary direction, withhold food and/or water for 12-24 hours

General Advice

- Advise importance of routine daily tick searches⁷ (as per MSTs), particularly if in a known tick area and season
- If ticks are found on people, seek medical advice



TREATMENT PROTOCOLS

PROTOCOL B: CLINICAL SIGNS OF TICK PARALYSIS WITH OR WITHOUT EVIDENCE OF A TICK OR TICK CRATER

To be used in conjunction with *Diagnostic Approach and Management of the Complicated Patient*.

Ensure the prognosis, cost and expectations are clearly communicated to, and understood by, the owner.

TREATMENT

■ Tick-Antitoxin Serum (TAS) – as soon as possible²

Dose rate

- The dose rate of TAS remains controversial and panel members varied in their preference for dose rates
- Methods used for dose rate calculation include: a standard dose rate in millilitres per kilogram; a standard volume per tick; or a standard volume per animal based on the assumption that only one tick, which inoculates a standard amount of toxin, is likely to be present⁸
- As a minimum it is advised to follow the label recommendations of the relevant TAS product in use

Factors to Consider

- A 2013 study in Sydney, NSW, showed none of the systems for calculating a dose rate of TAS (mL/kg, mL/tick, mL/animal) had any significant effect on the period from presentation to discharge, in either dogs or cats. In this study, doses ranged from 0.30-3.18 mL/kg for dogs and 0.45-1.79 mL/kg for cats with a median dose of 1 mL/kg for both dogs and cats⁸
- A 2003 survey of Queensland veterinarians indicated that most used a dose rate of 1 mL/kg of TAS in dogs¹³
- A 2001 study in dogs showed that doses > 0.1 mL/kg (range 0.1-8 mL/kg) did not alter mortality rate or time to recovery⁷
- In deciding a dose rate, consider the extent of unbound, circulating toxin available for TAS neutralisation, versus tissue-bound toxin which is therapeutically unavailable^{2,14}. This may be determined by the size, stage and number of ticks together with the severity of clinical signs of tick paralysis based on VAS and NMJ scores²

IV administration is recommended

- Give over 20 minutes^{2,15}
 - Can be diluted in 0.9% NaCl
 - Adverse reaction rate very low with slow infusion
- Monitor mental alertness, mucous membranes, capillary refill time, respiratory rate, heart rate, pulse quality and blood pressure¹⁵
 - If monitoring induces stress, consider visual assessment only
- If IV administration is not possible, in critically stressed cats and small dogs, consider intra-peritoneal administration²

Adverse Systemic Reactions to TAS

Although rare in dogs, can be lethal and present as either¹⁶

Tachycardia, injected mucous membranes, anxiety, pilo-erection, swelling of the lips, cutaneous wheals, erythema, vomiting, diarrhoea, coughing and dyspnoea (anaphylactic/anaphylactoid reaction)

Bradycardia, pale mucous membranes, hypotension, weakness, depression and reduced heart sounds^Δ

Treatment

- Discontinue TAS infusion and abort administration
- Administer adrenaline at 0.01 mg/kg (0.01 mL/kg of 1:1000 or 0.1 mL/kg of 1:10 000) IV every 5 to 15 minutes
- If shock has already developed, give adrenaline CRI at 0.05 ug/kg/min (0.003 mL/kg/hr of 1:1000 or 0.03 mL/kg/hr of 1:10 000)
- Supportive care including IV fluids and oxygen therapy
- Ancillary treatments (H1 and H2 antihistamines, corticosteroids, bronchodilators) have no evidence based benefit and are no substitute for adrenaline

Treatment

- Discontinue TAS infusion
- Administer atropine increments at 0.01-0.04 mg/kg (total doses as high as 0.1-0.2 mg/kg may be necessary)
- If asystole or persistent bradycardia, use adrenaline at 0.01 mg/kg (0.01 mL/kg of 1:1000 or 0.1 mL/kg of 1:10 000) IV every 5 to 15 minutes
- Supportive care including rapid IV fluids for volume expansion and oxygen therapy
- Reassess cardio-respiratory parameters
- If improved, restart TAS infusion at a slower rate

Currently there is no evidence to support the use of premedication including atropine, adrenaline and corticosteroids to prevent adverse systemic reactions to TAS¹⁵, and there is no evidence to support the use of acepromazine and/or atropine to reduce time to recovery⁸

Δ Also referred to as the Bezold-Jarisch Reflex

■ Stress reduction²

- Sedation to be used on a case by case basis
 - Acepromazine at 0.01-0.03 mg/kg IV, IM or SC and/or butorphanol at 0.1-0.4 mg/kg IV, IM or SC; or
 - Butorphanol CRI at 0.05 mg/kg/hr
 - Over-sedation may impact clinical judgement and increase risk of aspiration
- Environmental
 - Quiet area with dimmed lighting
 - Consider pheromone diffusers (Adaptil[®] or Feliway^{®18})

■ Full body clip

- As per the MSTs
- Ensure adequate sedation or GA to reduce stress-induced respiratory compromise

■ Administer an acaricide registered to treat and control *Ixodes holocyclus*²

■ Use clinical judgement in deciding whether parenteral anti-emetics and antacids are indicated for increased patient comfort

- There is currently no evidence available that these medications affect outcome

■ Assess and treat for aspiration pneumonia if indicated

Aspiration Pneumonia

If aspiration pneumonia is suspected, ideally confirm diagnostically by:

- Thoracic radiography^{2,9,17} – serial radiographs may assist in monitoring progress
- Complete Blood Count
- If possible (e.g. patient is anaesthetised and intubated), do a transtracheal or endotracheal wash or broncho-alveolar lavage to obtain samples for culture and sensitivity

If diagnostic procedures are not possible to due stress-induced respiratory compromise and/or while awaiting culture results, commence:

- Empirical antibiotic therapy
 - If no recent antibiotic history (> 3 months) and/or patient only just been hospitalised use penicillins IV, amoxicillin-clavulanic acid SC, or trimethoprim-sulfonamide IV or SC; or
 - If history of recent (< 3 months) use of penicillins or cephalosporins and/or patient already hospitalised for a few days, consider a combination of clindamycin IV and a fluoroquinolone; alternatively use an aminoglycoside. Take into consideration the contraindications for each of these antibiotics as well as protocols for antimicrobial stewardship
- Oxygen supplementation
- Nebulisation
- IV fluid therapy to ensure adequate hydration – as per the recommendations under *Supportive Care Protocol B*

DIAGNOSTICS

Perform a risk: benefit assessment for each test and consider the potential relative oxygen cost to the patient if stress is induced²

- Pulse oximetry²
- Blood gas analysis (if available)²
- Packed cell volume, total protein and electrolytes²
- Thoracic radiographs, if respiratory compromise^{2,9,17}
- Corneal fluorescein staining¹²
- Full body clip (as per MSTs)

SUPPORTIVE CARE

Requirements should be tailored on an individual basis

■ As a minimum requirement, place an IV catheter aseptically (and maintain patency)

■ IV fluid therapy

- Balanced electrolyte solution (Hartmann's Solution[®], Plasmalyte 148 or 0.9% NaCl) supplemented with potassium if indicated¹²
- Consider Plasmalyte 56 or 0.45% NaCl + 2.5% glucose if pulmonary parenchymal disease is a concern. Do not administer as a bolus or exceed maintenance fluid rates
- Judicious rates based on body surface area calculations and daily hydration reassessment

For patients > 2 kg and < 25 kg, give 2.5 mL/kg/hr

For patients < 2 kg and > 25 kg calculate the hourly fluid rate using $((BW \times 30) + 70)/24$

■ Oxygen supplementation^{9,12}

- Methods include

Nasal oxygen
Trans-/intra-tracheal
Oxygen chamber – watch body temperature
Flow by/face mask

- Essential in all cases with dyspnoea
- Humidification is helpful





NURSING CARE

- **Ocular care**
 - Lubrication
 - Cellulose-containing drops¹² (e.g. Viscotears®, Lacri-lube® or Celluvisc®) hourly
 - Lubricating eye ointment containing paraffin (e.g. VitA-POS®, Duratears®), preferably every 2 hours
 - Corneal examination and/or fluorescein staining at least once daily¹²
 - Add appropriate antibiotic topically if indicated
 - Partial temporary tarsorrhaphy only if complete lack of the palpebral reflex
- **Soft bedding**
 - Place in sternal recumbency² with head up and re-position slightly every 4-6 hours
- **Apply physiotherapy principles for recumbent patients**
- **Express the bladder every 4-6 hours if indicated¹²**
 - Consider placing a urinary Foley catheter with a closed collection system
- **Nil per os**
- **Airway care**
 - Ensure patency
 - Suction pharyngeal secretions as needed on a case by case basis (i.e. not to cause undue stress)²
 - Clear oesophagus by suctioning (achieved by passing long soft, nasal feeding tube)²
- **IV catheter care once daily to monitor for any signs of phlebitis and iatrogenic infection¹²**
- **Ensure environment is temperature controlled**

ROUTINE MONITORING

With consideration not to cause undue stress²

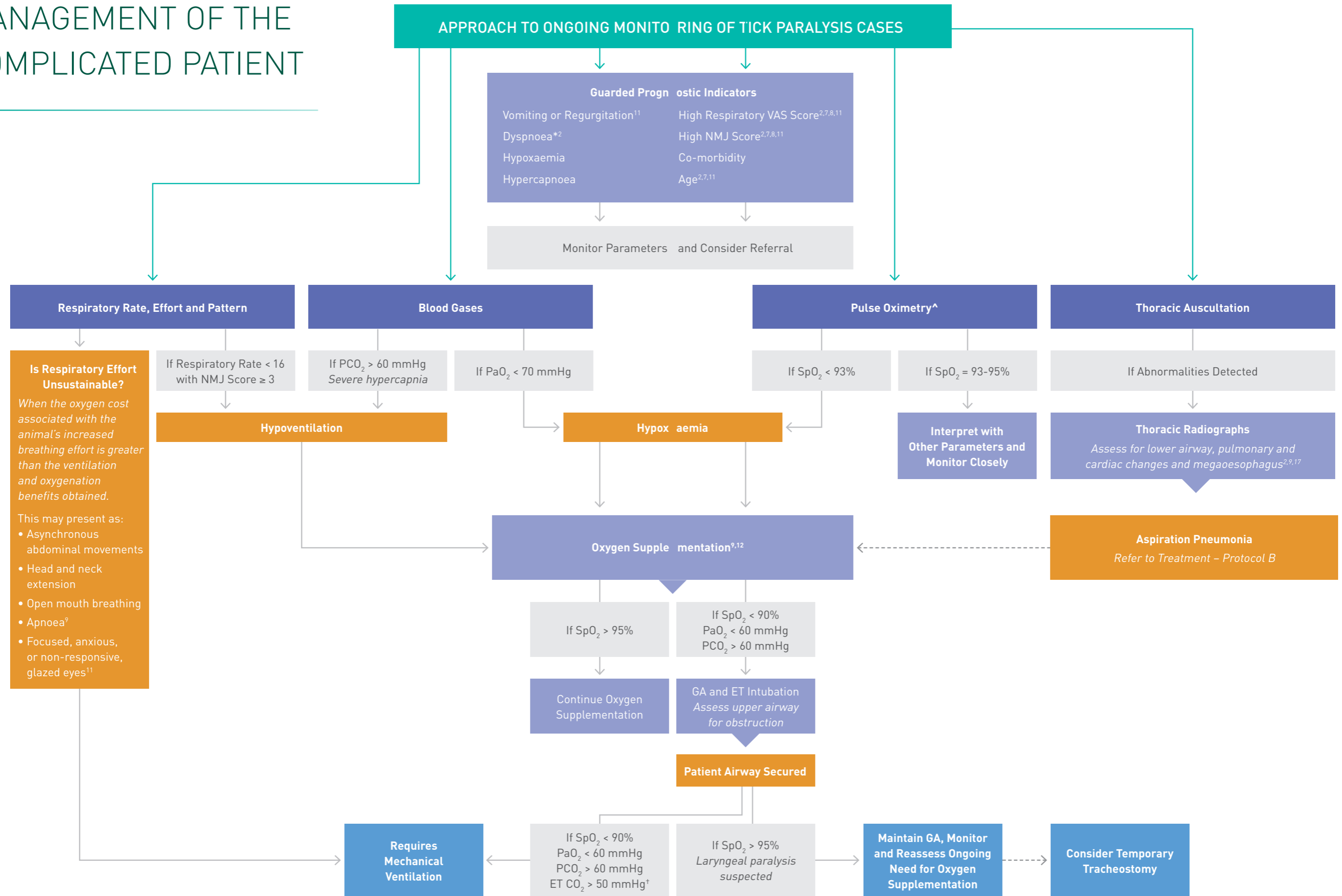
- Respiratory rate, effort and pattern every 4-6 hours
- Respiratory function (SpO₂ and/or blood gases if available) every 4-6 hours

Respiratory Concerns

1. Upper airway obstruction: laryngeal dysfunction, mucus plug
2. Pulmonary parenchymal disease: aspiration pneumonia, pulmonary oedema
3. Unsustainable respiratory effort
4. Hypoxaemia
5. Hypoventilation

- Check body temperature every 4-6 hours to ensure adequately maintained
- Heart rate and rhythm every 4-6 hours
- Neurological examination every 24 hours to ascertain case progression, with restaging as necessary
 - Consider video for objective comparison
- Tick search regularly² as per MSTs
- Electrolytes (and/or packed cell volume) every 24 hours or more frequently as indicated
- Biochemistry if indicated
- Weigh every 24 hours
 - Consider measuring fluid inputs and outputs

MANAGEMENT OF THE COMPLICATED PATIENT



* Dyspnoea (inspiratory and expiratory) always requires oxygen supplementation

† Care with interpretation of capnograph if patient is hypoventilating due to low tidal volume – needs mechanical ventilation¹²

[^]Does not evaluate hypoventilation, variable accuracy in conscious patients

FELINE PATIENTS: THE DIFFERENCES

The following outlines specific considerations for feline tick paralysis patients and is designed to be read as an adjunct to the *Diagnostic Approach, Protocol A, Protocol B* and *Management of the Complicated Patient*.

Initial Clinical Presentation

- More likely to be stressed and anxious⁶ compared to dogs
 - Experience both general and respiratory distress especially upper respiratory tract obstructive disease⁶
 - Take care not to exacerbate stress when handling
- Pronounced changes in phonation
- Respiratory signs⁶
 - Coughing
 - Expiratory dyspnoea (thought to be associated with airway spasm)
 - Cyanosis
 - Audible expiratory grunt has been noted in some cats
 - May present in a similar manner to early feline asthma² with a wheeze on auscultation
 - Thoracic radiographs may show pulmonary hyperinflation
- LMN paresis⁶
- Tail is seldom affected⁶
- Bladder voiding dysfunction⁶

Treatment

- Handle away from dogs to reduce stress¹²
- Cats are more likely to have an anaphylactic reaction to TAS than dogs¹⁶
- Treat in a quiet, dark, temperature controlled environment⁶
- Supplement oxygen if indicated using an oxygen cage¹²

Nursing Care

- It is paramount to minimise stress levels at all times
 - Minimise handling of cats^{6,12}
 - Consider the use of Feliway^{®18} (e.g. soak towels, rub on face, diffuser)
- Be less invasive with the approach
- Due to laryngeal sensitivity, care should be taken with procedures involving the pharyngeal/laryngeal region (e.g. suctioning)

Anaesthesia and Sedation

■ Ketamine/benzodiazepine CRI:

- Ketamine 0.5-2.0 mg/kg IV loading dose, followed by a CRI at 0.1-1.0 mg/kg/hr
 - Combine with either:
 - Diazepam 0.5-1.0 mg/kg IV loading dose, then 0.1-0.5 mg/kg/hr; or
 - Midazolam 0.1-0.5 mg/kg IV loading dose, then 0.1-0.5 mg/kg/hr
- Ketamine considerations:
 - Can cause bronchodilation¹⁹
 - Is contraindicated in cats with hyperthyroidism, hypertrophic or restrictive cardiomyopathy and/or hypertension¹⁹
 - Can have a cumulative effect, with slow elimination depending on dose and route of administration²⁰

■ Alfaxalone CRI:

- 7-8 mg/kg/hr IV (premedicated) or 10-11 mg/kg/hr IV (unpremedicated). The actual dose will be based on the response of the individual patient¹⁹

■ Monitor depth of sedation/general anaesthesia closely

■ Cats more commonly require sedation and are less likely to require a general anaesthetic and endotracheal intubation compared to dogs⁶

■ Temporary tracheostomies are generally not recommended in cats

Prognosis

- Rarely develop aspiration pneumonia¹²
- Hypoventilation is the more common cause of respiratory failure¹²
- Megaoesophagus is not seen as in dogs^{2,17}
- The survival rate for mechanical ventilation in cats with tick paralysis is 83.3%²¹
- The mortality rate of cats with tick paralysis is lower than in dogs (0.6%⁶ and 4-10% respectively)
- In cats multiple ticks and a higher NMJ score are associated with a longer time to recovery⁸

Prevention

- Apply acaricide prophylaxis registered for the control of *Ixodes holocyclus* in cats
 - Fipronil spray recommended
 - Follow label instructions
 - Care with reduced body temperature
- Tick search
 - The pattern of distribution includes the head, neck, under the chin, hard palate, between the shoulder blades, caudal to the elbow, chest/belly, flank/back, legs, external anus, inside the anus and the tail^{3,6}

TIPS FOR TRANSPORTATION OF TICK PARALYSIS CASES TO REFERRAL CENTRES

Refer Early

- See *Management of the Complicated Patient*
- Equipment onboard
 - Basic crash cart including resuscitation drugs and endotracheal tube, mobile ventilator, oxygen supply and Ambu-bag®
- Advise referral centre of arrival time

If patient is anaesthetised

- Vet and/or vet nurse recommended to travel with patient to maintain airway and monitor general anaesthesia
- Owner assistance not recommended

Legal considerations

- Oxygen tank storage during transportation

TIPS FOR BRACHYCEPHALIC BREEDS

- Assessment and maintenance of airway patency is vital
- Consider existing or previous upper airway disease
- Be aware that oxygen delivery is limited when using the nasal catheter method. Consider trans-tracheal oxygen supplementation in order to bypass the narrow upper airways
- Avoid over-sedating brachycephalic patients as it can further compromise airway patency
- Consider general anaesthesia and endotracheal intubation early in the course of the disease
- Temporary tracheostomy post general anaesthetic and endotracheal tube placement and/or mechanical ventilation are recommended to facilitate a less complicated recovery
 - Patients with a temporary tracheostomy need constant monitoring
- Monitor body temperature for early detection and correction of hyperthermia or hypothermia
- Keep in a temperature controlled environment
- Manage owner expectations with regards to increased morbidity

MANAGING HYPOVENTILATION WITH LIMITED VETERINARY FACILITIES

- If hypoventilation is the suspected cause of an animal's deterioration:
 - Remove or reduce the level of sedation as this may be contributing to hypoventilation
 - Maintain the patient in sternal position
 - Perform intermittent manual positive pressure ventilation under general anaesthesia to help reduce respiratory muscle fatigue
 - Oxygen supplementation is recommended 24 hours a day for all respiratory compromised patients

INTENSIVE CARE OF THE ANAESTHETISED AND INTUBATED PATIENT

- Ocular care (refer to *Nursing Care – Protocol B*)
- Oral care¹²
 - Consider using intravenous giving set tubing as ET tube ties
 - Keep the mouth slightly open to reduce pressure on the tongue
 - Rinse the mouth once daily using sterile saline and dilute chlorhexidine solution
 - Gentle brushing of teeth with an extra soft toothbrush may be beneficial
 - Apply glycerine to keep the tongue moist or wrap the tongue in moist swabs
 - Re-position the pulse oximeter probe every 2-4 hours to prevent pressure necrosis
- Change the ET tube every 24 hours or as necessary
 - The frequency depends on the quantity of secretions and risk of ET tube obstruction
 - Use a new or sterile ET tube placed aseptically
- Monitor electrolytes, packed cell volume/total protein and blood glucose every 12 hours
- Assess blood gases when necessary (or ideally, every 6 hours)
- Consider performing a complete blood count and biochemistry panel every 24 hours
- Measure fluid inputs and outputs
- Measure bodyweight every 12-24 hours



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Disclaimer: This document aims to provide guidance to veterinarians managing Australian Tick Paralysis cases of dogs and cats, and should not replace the attending veterinarian's clinical judgement of individual cases.

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