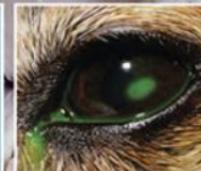


SECOND EDITION

Differential Diagnosis in Small Animal Medicine



Alex Gough • Kate Murphy

WILEY Blackwell

Differential Diagnosis in Small Animal Medicine

Differential Diagnosis in Small Animal Medicine

Second Edition

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Introduction

The first edition of this book was written by Alex Gough to fill a gap in the market. The aim was to provide a ready list of differential diagnoses to assist in the investigation of challenging medical cases, and the sales of the book would suggest this was a success.

This second edition has been co-authored by Alex Gough and Kate Murphy. Content has been reviewed and expanded where needed and some sections have been removed.

This book provides a ready reference for differential diagnoses for the majority of medical presentations that are encountered in general practice, including both common and uncommon conditions. This text should be of use to veterinary students, general practitioners, veterinary interns, residents and anyone who cannot fully carry these lists around in their heads. We hope clinicians find it useful.

The differential diagnosis list is one of the most important aspects of the problem-oriented approach to clinical diagnosis. For those who are not familiar with the problem-oriented approach, a brief outline follows.

As the name implies, problem-oriented medical management (POMM) concentrates on the individual problems of a patient. A differential diagnosis list should be made for each and every problem that is found in a patient, whether in the history, the physical examination, imaging or clinicopathological tests. Although superficially this may not sound very ‘holistic’, in fact, if all the patient’s problems are considered individually, the whole patient will have been evaluated, without falling into the trap of presuming that all of the findings are caused by a single condition. Some problems are of course less specific and less emphasis is given to the problem solving on those signs, e.g. lethargy and inappetence in a vomiting, jaundiced pet.

The problem-oriented approach starts with a thorough history, and it is important to discover what the owners perceive to be the main problems – after all, they usually know their animal better than the clinician does. However, there may be relevant historical signs that the owners had not considered significant, so failing to systematically ask all the questions which could be of importance in a case can lead to overlooking important information.

In every case, a complete physical examination should be carried out, including body systems that are not apparently of immediate concern.

Once the history has been taken and the physical examination has been completed, the clinician should list every problem (ideally rank the problems) that has been discovered. Problems may include such findings as exercise intolerance, pruritus, pyrexia or a heart murmur. A differential diagnosis list should then be created for every problem. The list should be appropriate to that animal. There is no point listing feline leukaemia virus as a likely diagnosis in a dog!

An attempt should also be made to categorise the conditions in order of likelihood, or at least into common and uncommon. Although the more common conditions have been indicated in this book with an asterisk (*), there are few objective data regarding the true incidence of conditions, and the estimate of incidence is largely subjective and influenced by the authors' geographical location and caseload. Familiarity with how common conditions are and their local incidence will help prioritise differential lists. The clinician can then select diagnostic tests in a rough order of probability, although rarer but life-threatening conditions, such as hypoadrenocorticism, should also be ruled out early in the course of investigations. Some authorities rightly point out that emphasis should be placed on historical and physical signs and that 'over-investigating' can be expensive and potentially detrimental to the patient.

However, it is possible to place too much importance on probabilities and how commonly a condition occurs. The newly qualified veterinary surgeon will often look for the rare but exciting and memorable condition they learned about at college, while the experienced practitioner will often remind them that 'common things are common' and suggest they restrict their investigations only to commonly encountered conditions. The ideal approach is probably somewhere in between. The problem-oriented approach means that all differentials should have been considered and investigations can be targeted, but if a diagnosis is not made, the list should be revisited to consider other appropriate testing.

Some authorities prefer to categorise the initial approach to a case differently and describe the subjective and objective assessment of a patient as

part of the SOAP approach (Subjective, Objective, Assessment, Plan). The principle is the same however, in that a detailed history or physical examination is the basis of the initial differential list.

Once the differential diagnosis list has been formulated, the clinician is in a position to select appropriate tests to aid in making a definitive diagnosis. Prioritising the selection of diagnostic tests helps avoid placing undue financial strain on the client and inappropriate or unnecessary testing on the patient. Tests may be prioritised on such factors as the number of conditions which will be ruled in and out, the sensitivity and specificity of the tests; the risk/benefit to the patient ratio; the financial cost/benefit to the client ratio; the incidence or prevalence of the condition being tested for and the importance of the condition being tested for (e.g. hypoadrenocorticism is uncommon, but the consequences of failing to diagnose it may be serious).

After the results of initial testing have been obtained the clinician may be in a position to make a definitive diagnosis. Often, however, it is necessary to refine the differential list and select further appropriate testing. The differential list may be reformulated as often as is necessary until a diagnosis for that problem is made. Often, a single diagnosis will tie in all the problems satisfactorily. However, in many cases, particularly in geriatric patients, concurrent disorders will require multiple diagnoses.

For problem cases in which a clear diagnosis is not made or the patient fails to respond to treatment as expected, returning to the beginning with the history and physical examination, with the condition often having progressed, can be helpful. However, very few tests are 100% sensitive and specific, and many ‘definitive’ diagnoses in fact leave room for some doubt. The clinician should never be afraid to revise the initial diagnosis if further evidence comes to light. Those who are concerned that failing to make the correct diagnosis in every case is somehow a sign of inferior clinical abilities should take heart from a 2004 study from the School of Veterinary Medicine at the University of California. In this paper, clinical and post-mortem diagnoses of 623 dogs treated between 1989 and 1999 at the Veterinary Teaching Hospital were compared. It was found that the post-mortem diagnosis, presumed to be the correct diagnosis, differed from the clinical diagnosis in approximately one-third of cases.

This book is organised into five parts. Part 1 deals with signs likely to be uncovered during history taking. Part 2 deals with signs encountered at the physical examination. Part 3 deals with imaging findings, Part 4 with clinicopathological findings and Part 5 with electrophysiological findings.

The individual lists are largely organised alphabetically. The more common conditions are labelled with an asterisk, but, as stated above, whether

a condition is considered to be common is largely a matter of subjective opinion. Those conditions that are predominantly or exclusively found only in dogs are marked with a (D) and those in cats are marked with a (C).

Sources for the information in this book are wide ranging. A large number of textbooks, were consulted, but in most cases it was necessary to expand the lists found in these sources, using information from veterinary journals and conference proceedings.

Although there are undoubtedly omissions from some of the lists, encompassing as this book does virtually the whole of small animal veterinary medicine, we have tried to make it as comprehensive as possible. We would be happy to hear of any omissions, corrections or comments on the text, which can be e-mailed with any supporting references to alex.gough@bath-vetreferrals.co.uk.

The following colleagues provided comments on the text of the first edition for which we are grateful: Simon Platt BVM&S DipACVIM DipECVN MRCVS, Chris Belford BVSc DVSc FACVSc RCVS Specialist Pathologist Dip Wldl Mgt, Theresa McCann BVSc CertSAM MRCVS, Rosie McGregor BVSc CertVD CertVC MRCVS, Mark Bush MA VetMB CertSAS MRCVS, Alison Thomas BVSc CertSAM MRCVS, Mark Maltman BVSc CertSAM CertVC MRCVS, Panagiotis Mantis DVM DipECVDI MRCVS, Axiom Laboratories, Stuart Caton BA VetMB CertSAM MRCVS, Tim Knott BSc BVSc CertVetOphth MRCVS, Lisa Phillips CertVR BVetMed MRCVS, Roderick MacGregor BVM&S CertVetOphth CertSAS MRCVS and Mark Owen BVSc CertSAO MRCVS. Any errors are of course ours and not theirs. We are also grateful to Justinia Wood at Wiley for her support in this project.

Key

* = more common condition

(D) = condition seen exclusively or predominantly in dogs

(C) = condition seen exclusively or predominantly in cats

q.v. = more information can be found on this condition elsewhere in this book – see Index

PART 1

HISTORICAL SIGNS

1.1 General, systemic and metabolic historical signs

1.1.1 Polyuria/polydipsia

Diet

Increased salt intake
Very-low-protein diet

Drugs/toxins

Aminophylline
Corticosteroids
Delmadinone acetate
Diuretics
Ethylene glycol
Indomethacin

- Lilies

Lithium

- Melamine

NPK fertilisers
Paraquat
Phenobarbitone
Potassium bromide

Primidone
Proligestone
• Raisins/grapes
Terfenadine
Theophylline
Vitamin D rodenticides

Electrolyte disorders

Hypercalcaemia *q.v.*
Hypernatraemia *q.v.*
• Primary
• Secondary to dehydration, lack of intake, excessive loss of water, severe vomiting/diarrhoea, etc.
Hypokalaemia *q.v.*

Endocrine disease

Acromegaly
Diabetes mellitus*
Diabetes insipidus
• Central
• Nephrogenic
Hyperadrenocorticism
Hyperthyroidism* (C)
Hypoadrenocorticism (D)
Insulinoma
Pheochromocytoma
Primary hyperaldosteronism
Primary hyperparathyroidism

Hepatobiliary disease, e.g.

Hepatic neoplasia* *q.v.*
Hepatitis/cholangiohepatitis* *q.v.*

Infectious disease, e.g.

Toxaemia, e.g.
• Pyometra*

Miscellaneous

Congenital lack of ADH receptors
Hypothalamic disease
Pericardial effusion

Polycythaemia
Psychogenic*

Neoplasia*

Physiological

Exercise
High environmental temperature

Renal disorders

Acute kidney injury* *q.v.*
Chronic kidney disease* *q.v.*
Following urethral obstruction*
Glomerulonephritis
Primary renal glycosuria
Pyelonephritis
Renal medullary washout

Note: Polyuria and polydipsia are considered together here, since one will lead to the other, with only a few exceptions. These include polydipsia in the face of obstructive lower urinary tract disease or oliguric renal failure and polyuria which is not matched by fluid intake, in which case dehydration will rapidly follow. None of these scenarios are encountered commonly in practice. Polydipsia without polyuria can occur in situations of increased urinary loss of fluid, such as after strenuous exercise.

1.1.2 Weight loss

Decreased nutrient intake

Anorexia* *q.v.*
Diet

- Poor-quality diet
- Underfeeding

Dysphagia *q.v.*
Oral disease, e.g.

- Dental disease
- Masticatory myositis
- Temporomandibular joint disease

Regurgitation *q.v.*

Increased nutrient loss

Burns

Chronic blood loss

- Epistaxis *q.v.*
- Haematemesis *q.v.*
- Haematuria *q.v.*
- Melaena *q.v.*

Diabetes mellitus/diabetic ketoacidosis*

Effusions *q.v.*

Fanconi syndrome (D)

Intestinal parasites*

Neoplasia*

Protein-losing enteropathy*

Protein-losing nephropathy

Increased nutrient use

Endocrine, e.g.

Hyperthyroidism* (C)

*Neoplasia**

Physiological

Cold environment

Exercise

Fever *q.v.*

Lactation*

Pregnancy*

Maldigestion/malabsorption

Cardiac failure

Exocrine pancreatic insufficiency

Hepatic failure/bile salt deficiency *q.v.*

Hypoadrenocorticism (D)

Neoplasia*

Renal disease* *q.v.*

Small intestinal disease* *q.v.*, e.g.

- Antibiotic-responsive diarrhoea
- Inflammatory bowel disease
- Lymphangiectasia

Regurgitation and vomiting* *q.v.*

1.1.3 Weight gain

Decreased energy utilisation, e.g.

- Decreased exercise

Fluid accumulation

Ascites* *q.v.*

Peripheral oedema *q.v.*

Pleural effusion

Increased body fat

Overeating

Boredom

Excessive appetite (normal in some breeds)

High-calorie diets

Overfeeding*

Endocrinopathies

Acromegaly

Hyperadrenocorticism

Hypogonadism

Hypothyroidism* (D)

Insulinoma

Increased organ size

Hepatomegaly* *q.v.*

Renomegaly *q.v.*

Splenomegaly* *q.v.*

Uterine enlargement *q.v.*

- Pregnancy*

- Pyometra*

Neoplasia

Large abdominal mass (often associated with poor body condition)*

Drugs, e.g.

- Corticosteroids

1.1.4 Polyphagia

Behavioural/psychological

Boredom

Normal in some breeds*

Psychogenic, e.g. problem with satiety centre

Diet

Highly palatable food*

Poor-quality food

Drugs, e.g.

Benzodiazepines

Corticosteroids

Mirtazapine

Progestagens

Endocrine

Acromegaly

Diabetes mellitus*

Hyperadrenocorticism

Hyperthyroidism *(C)

Insulinoma

Increased nutrient loss, e.g.

Exocrine pancreatic insufficiency

Malabsorption

- Small intestinal disease

Increased nutrient use, e.g.

Neoplasia

Malassimilation q.v.

Physiological

Cold environment

Increased exercise

Lactation

Pregnancy

1.1.5 Anorexia/inappetence

Anorexia, primary

- Intracranial disease, e.g.
- Hypothalamic neoplasia

Anorexia, secondary

Anosmia

- Chronic rhinitis *q.v.*
- Nasal neoplasia
- Other nasal disease
- Neurological disease

Endocrine disease, e.g.

- Diabetic ketoacidosis
- Hypoadrenocorticism (D)

Fever* *q.v.*

Gastrointestinal disease *q.v.*, e.g.

- Gastritis
- Inflammatory bowel disease*

Heart disease, e.g.

- Cardiac failure*

Hepatic disease* *q.v.*

Infection*

Metabolic abnormalities, e.g.

- Hypercalcaemia *q.v.*
- Hypokalaemia *q.v.*

Pain*

Pancreatic disease*, e.g.

- Pancreatitis

Renal disease* *q.v.*

Respiratory disease, e.g.

- Airway disease* *q.v.*
- Diaphragmatic hernia
- Pleural effusion* *q.v.*
- Pneumonia *q.v.*

Diet

Recent dietary changes*

Unpalatable diet*

Difficulty with mastication

Dental disease*

Lingual disease

Oral neoplasia*

Oral ulceration, e.g.

- Ingestion of caustic or acidic substances*
- Renal disease

Difficulty with prehension

Blindness *q.v.*

Myopathy, e.g.

- Masticatory myositis
- Tetanus

Pain on opening jaw, e.g.

- Mandibular or maxillary fracture
- Retrobulbar abscess
- Skull fractures
- Soft tissue trauma
- Temporomandibular joint disease

Trigeminal nerve disease, e.g.

- Neoplasia
- Trigeminal neuritis

Difficulty with swallowing

Pharyngeal disease

Foreign body*

Neoplasia

Neurological disease

Ulceration

Oesophageal disease, e.g.

Foreign body*

Megaoesophagus

Neoplasia

Stricture

Ulceration

Vascular ring anomaly

Drugs

- Acetazolamide
- Amiodarone
- Amphotericin B
- Bethanechol
- Bromocriptine
- Butorphanol
- Cardiac glycosides
- Chlorambucil
- Diazoxide
- Doxorubicin
- Fentanyl
- Hydralazine
- Itraconazole
- Ketoconazole
- Melphalan
- Methimazole
- Mitzotane
- Nicotinamide
- Oxytetracycline (C)
- Penicillamine
- Theophylline
- Trimethoprim/sulphonamide (C)

Psychological/behavioural* factors

- Altered schedule
- New family members
- New house
- New pets

1.1.6 Failure to grow**With good body condition**

Chondrodystrophy (normal in many breeds)* (D)

Endocrine disorders

- Congenital hyposomatotropism
(pituitary dwarfism)
- Congenital hypothyroidism

With poor body condition

Dietary intolerance

Exocrine pancreatic insufficiency*

Inadequate nutrient intake

- Anorexia *q.v.*
- Poor-quality diet
- Underfeeding

Cardiac disorders, e.g.

- Congenital
- Endocarditis

Endocrine disease

- Diabetes insipidus
- Diabetes mellitus*
- Hypoadrenocorticism (D)

Gastrointestinal disease, e.g.

- Histoplasmosis
- Obstruction, e.g.
 - Foreign body*
 - Intussusception*
- Parasites*

Hepatic disorders, e.g.

- Hepatitis *q.v.*
- Portosystemic shunt

Inflammatory disease

Oesophageal disorders, e.g.

- Megaoesophagus *q.v.*
- Vascular ring anomaly (e.g. persistent right aortic arch)

Renal disease

- Congenital kidney disease
- Glomerulonephritis
- Pyelonephritis

1.1.7 Syncope/collapse

Cardiovascular dysfunction

Bradyarrhythmias q.v., e.g.

- High-grade second-degree heart block
- Sick sinus syndrome (D)

- Third-degree heart block

Myocardial failure

Myocardial infarction

Cardiac disease

- Congenital, e.g.
 - Aortic stenosis (D)
 - Pulmonic stenosis (D)
- Hypertrophic obstructive cardiomyopathy
- Pericardial effusion* (D)
- Pulmonary hypertension
- Arterial obstruction, e.g.
 - Neoplasia
 - Thrombosis

Shock *q.v.*

Tachyarrhythmias q.v.

- Supraventricular tachycardia*
- Ventricular tachycardia*

Drugs

Anti-arrhythmics, e.g.

- Atenolol
- Digoxin
- Propranolol
- Quinidine

Sedatives, e.g.

- Phenothiazines

Vasodilators, e.g.

- ACE inhibitors
- Hydralazine
- Nitroglycerine

Hypoxaemic disease

Carboxyhaemoglobinaemia

Methaemoglobinaemia

Pleural/thoracic disorders, e.g.

- Pleural effusion
- Pneumothorax
- Rib fractures

Respiratory disease

- Lower airway, e.g.
 - Pneumonia
 - Small airway disease
- Upper airway, e.g.
 - Brachycephalic obstructive airway syndrome
 - Laryngeal paralysis
 - Tracheal collapse
 - Tracheal obstruction
- Ventilation–perfusion mismatch, e.g.
 - Pulmonary thromboembolism (PTE)
 - Lung collapse

Right-to-left cardiac shunt, e.g.

- Reverse-shunting patent ductus arteriosus
- Severe anaemia

Metabolic/endocrine disorders

Diabetic ketoacidosis

Hypercalcaemia/hypocalcaemia *q.v.*

Hypernatraemia/hyponatraemia *q.v.*

Hyperthermia/hypothermia *q.v.*

Hypoglycaemia *q.v.*

Hyperkalaemia/hypokalaemia *q.v.*

Severe acidosis *q.v.*

Severe alkalosis *q.v.*

Pheochromocytoma

Hypoadrenocorticism

Insulinoma

Miscellaneous

Carotid sinus stimulation, e.g.

- Neoplasia
- Tight collar

Hyperventilation

Postural hypotension

Tussive/cough syncope

Myopathies

Corticosteroid myopathy

Exertional myopathy

Hypocalcaemic myopathy

Hypokalaemic myopathy
Malignant hyperthermia
Mitochondrial myopathy
Muscular dystrophy
Polymyopathy
Polymyositis
Protozoal myopathy

Neurological dysfunction

Brainstem disease

Diffuse cerebral dysfunction, e.g.

- Encephalopathy
- Haemorrhage
- Hydrocephalus
- Inflammation
- Oedema
- Space-occupying lesion
- Trauma

Fibrocartilaginous embolism

Glossopharyngeal neuralgia

Lower motor neurone disorders

- Endocrine neuropathies, e.g.
 - Diabetes mellitus*
 - Hyperadrenocorticism
 - Hypothyroidism* (D)
- Lumbosacral disease
- Paraneoplastic neuropathies, e.g.
 - Insulinoma
- Peripheral nerve neoplasia
- Polyneuropathy, e. g.
 - Polyradiculoneuropathy

Micturition-related collapse

Narcolepsy/cataplexy

Neuromuscular junction disorders

- Botulism
- Myasthenia gravis

Seizures *q.v.*

Swallowing-related collapse

Upper motor neurone disorders

- Central vestibular disease

- Cerebellar disease
- Cerebral disease
- Peripheral vestibular disease
- Spinal disease

Skeletal/joint disorders

Bilateral cranial cruciate disease
Bilateral hip disease
Discospondylitis
Intervertebral disc disease
Multiple myeloma
Osteoarthritis
Panosteitis
Patellar luxation
Polyarthritis

1.1.8 Weakness

Cardiovascular diseases

Bradyarrhythmias *q.v.*, e.g.

- High-grade second-degree heart block
- Sick sinus syndrome (D)
- Third-degree heart block

Congestive heart failure*
Hypertension* *q.v.*
Hypotension* *q.v.*
Pericardial effusion* *q.v.*
Tachyarrhythmias *q.v.*, e.g.
Ventricular tachycardia*

- Supraventricular tachycardia

Drugs/toxins

Alphachloralose
Anticoagulant rodenticides
Anticonvulsants
Antihistamines
Blue-green algae
Cannabis
Diclofenac sodium

Glucocorticoids

Hypotensive agents, e.g.

- Beta blockers
- Vasodilators

Ibuprofen

Insulin overdosage

Iron salts

Mistletoe

Opioids

Organophosphates

Petroleum distillates

Phenoxy acid herbicides

Pyrethrin/pyrethroids

Rhododendron

Salbutamol

Sedatives

Endocrine diseases

Diabetes mellitus*

Hyperadrenocorticism

Hyperparathyroidism

Hypoadrenocorticism (D)

Hypoparathyroidism

Hypothyroidism* (D)

Insulinoma

Haematological diseases

Anaemia* *q.v.*

Hyperviscosity syndrome, e.g. polycythaemia

Inflammatory/Immune-mediated diseases

Chronic inflammatory conditions*

Immune-mediated haemolytic anaemia* *q.v.*

Immune-mediated polyarthritis

Infectious diseases*

Bacterial

Viral

Fungal

Rickettsial

Protozoal and other parasitic diseases

Metabolic disease

Acid–base disorders

- Acidosis *q.v.*
- Alkalosis *q.v.*

Electrolyte disorders*

- Hypercalcaemia*/hypocalcaemia *q.v.*
- Hyperkalaemia/hypokalaemia* *q.v.*
- Hyernatraemia/hyponatraemia *q.v.*

Hepatic failure* *q.v.*

Hyper-/hypoglycaemia *q.v.*

Renal disease* *q.v.*

Neurological diseases

Intracranial disease, e.g.

Cerebrovascular accident

- Epilepsy* *q.v.*

Infection

Inflammation

Space-occupying lesions

Vestibular disease

Neuromuscular disease, e.g.

- Botulism
- Myasthenia gravis
- Myopathies
- Tick paralysis

Peripheral polyneuropathies

Drugs/toxins, e.g.

- Cisplatin
- Lead
- Vincristine

Endocrine disorders, e.g.

- Diabetes mellitus*
- Hyperadrenocorticism
- Hypothyroidism* (D)

Polyradiculoneuritis

Paraneoplastic disorders

Spinal cord disease q.v., e.g.

Fibrocartilaginous embolism

Infection
Inflammation
Intervertebral disc disease* (D)
Neoplasia
Trauma*

Vestibular disease q.v.*

- Central vestibular disease
- Peripheral vestibular disease

Nutritional disorders

Cachexia, e.g.

Heart failure*
Neoplasia*

Inadequate calorie intake, e.g.

Anorexia* q.v.
Poor-quality diet

Specific nutrient deficiencies, e.g.

Minerals
Vitamins

Physiological factors

Over-exercise
Pain*
Stress/anxiety*

Respiratory diseases

Airway obstruction, e.g.

- Feline asthma* (C)
- Foreign body*
- Neoplasia *
- Pleural effusion*
- Pulmonary hypertension
- Pulmonary oedema* q.v.
- Pulmonary thromboembolism

Severe pulmonary parenchymal disease

Systemic disorders

Dehydration*
Fever* q.v.
Neoplasia*

1.2 Gastrointestinal/abdominal historical signs

1.2.1 Ptyalism/salivation/hypersalivation

Drugs/toxins

Adder bites
Alphachloralose
Baclofen
Batteries
Benzodiazepines
Bethanechol
Blue-green algae
Cannabis
Carbamate
Chocolate/theobromine
Cotoneaster
Cyanoacrylate adhesives
Daffodil
Dieffenbachia
Dinoprost tromethamine
Glyphosphate
Horse chestnut
Ivermectin
Ketamine
Laburnum
Levamisole (C)
Loperamide
Metronidazole
Mistletoe
NPK fertilisers
Organophosphates
Paracetamol
Paraquat
Phenoxy acid herbicides
Plastic explosives
Plants
Pyrethrin/pyrethroids

Pyridostigmine
Rhododendron
Rowan
Terfenadine
Toads
Trimethoprim/sulphonamide (C)
Xylazine

Nausea/regurgitation/vomiting q.v.*

Neurological disease

Cataplexy/narcolepsy
Hepatic encephalopathy
Intracranial neoplasia
Partial seizures

Normal breed variation, e.g.*

St Bernard

Oral cavity disease

Dental disease*
Foreign body*
Neoplasia*, e.g. tonsillar
Inability to close mouth, e.g.

- Mandibular trauma*
- Trigeminal nerve disease, e.g.
 - Idiopathic trigeminal neuritis
 - Infiltrating neoplasia, e.g.
 - Lymphoma
 - Nerve sheath tumours

Infection, e.g.

- Rabies

Inflammation, e.g.

- Faucitis*
- Lip fold dermatitis
- Gingivitis*
- Glossitis*
- Oesophagitis*
- Stomatitis*

Ulceration*, e.g.

- Chronic kidney disease*
- Immune-mediated disease
- Ingestion of irritant substance

Physiological factors

Appetite stimulation*

Fear*

Stress*

Salivary gland disease q.v.

Salivary gland necrosis/sialadenitis

Salivary mucocoele

Sialadenosis

1.2.2 Gagging/retching

Congenital disease

Achalasia, e.g.

- Cricopharyngeal achalasia (D)
- Cleft palate
Hydrocephalus

Inflammatory and infectious disease

Asthma* (C)

Bacterial encephalitis

Fungal disease

- Granuloma complex

Idiopathic glossopharyngitis

Laryngitis*

Nasopharyngeal disease, e.g. polyps (C)

Pharyngitis*

Rabies

Rhinitis*

Sialadenitis

Viral encephalitis

Neoplasia

Central nervous system
Epiglottis
Inner ear
Nasal
Pharyngeal
Tonsillar

Neurological disease

Brainstem disease
Cranial nerve defects (V, VII, IX, XII)
Encephalitis
Laryngeal paralysis*
Muscular dystrophy
Myasthenia gravis

Nutrition

Food texture and size

Respiratory disease (expectoration), e.g.

Bronchitis*
Haemorrhage
Pulmonary oedema*

Systemic disorders

Hypocalcaemia
Renal disease*

Toxic

Botulism
Ingestion of irritant chemical
Smoke

Trauma

Foreign body*
Pharyngeal haematoma
Styloid apparatus trauma
Tracheal rupture

1.2.3 Dysphagia

Infectious/inflammatory disease

Oral disease

- Dental disease*
- Osteomyelitis of the jaw
- Periodontitis*
- Pharyngitis*
- Rabies
- Retrobulbar abscess
- Severe gingivitis*
- Salivary gland disease, e.g.
 - Sialadenitis
- Tooth root abscess*
- Ulceration, e.g.
 - Ingestion of irritant substance
 - Renal disease*

Neurological/neuromuscular disease

- Cricopharyngeal achalasia
- Myasthenia gravis
- Myopathy, e.g.
 - Masticatory myopathy
- Trigeminal nerve disease, e.g.
 - Intracranial disease
 - Trigeminal neuritis

Obstruction

- Foreign body*
- Granuloma
- Neoplasia
- Sialocoele

Temporomandibular joint disease

Trauma*

- Fracture
- Haematoma
- Laceration

1.2.4 Regurgitation

Endocrine disease

Hypoadrenocorticism (D)
Hypothyroidism* (D)

Gastric disease (can develop regurgitation secondary to outflow obstruction)

Gastric dilatation/volvulus* (D)
Hiatal hernia

- Gastro-oesophageal intussusception

Pyloric outflow obstruction, e.g.

- Foreign body*
- Neoplasia
- Pyloric stenosis

Immune-mediated disease

Dermatomyositis (D)
Polymyositis
Systemic lupus erythematosus

Neurological disease

Central nervous system disease, e.g.
Brainstem disease
Distemper infection (D)
Infection
Inflammation
Intracranial space-occupying lesion
Storage diseases
Trauma

Neuromuscular junctionopathies, e.g.
Anticholinesterase toxicity
Botulism
Myasthenia gravis
Tetanus

Peripheral neuropathies, e.g.
Giant cell axonal neuropathy (D)
Lead poisoning

- Polyneuritis
- Polyradiculoneuritis
 - Idiopathic
 - Tick paralysis

Oesophageal disease

- Foreign body*
- Granuloma, e.g. *Spirocerca lupi*
- Mediastinal mass (extraluminal obstruction)
- Megaoesophagus
 - Idiopathic
 - Acquired
- Neoplasia
- Oesophageal diverticulum
- Oesophageal fistula
- Oesophageal inclusion cysts
- Oesophagitis*, e.g.
 - Secondary to gastric reflux
 - Severe vomiting
 - Post anaesthesia
 - Idiopathic
 - Ingestion irritants
- Stricture
- Vascular ring anomaly, e.g.
 - Persistent right aortic arch

Salivary gland disease

- Sialadenitis
- Sialadenosis

1.2.5 Vomiting

ACUTE VOMITING

Dietary

- Dietary indiscretion*
- Dietary intolerance*
- Sudden change in diet*

Drugs/toxins

Acetazolamide
Adder bite
Allopurinol
Alpha-2 agonists
Aminophylline
Amphotericin B
Apomorphine
Aspirin
Atipamezole
Atropine
Batteries
Benzalkonium chloride
Bethanechol
Blue-green algae
Borax
Bromocriptine
Calcium edetate
Carbimazole
Carboplatin
Cardiac glycosides
Cephalexin
Chlorambucil
Chloramphenicol
Chlorphenamine
Clomipramine
Colchicine
Cotoneaster
Cyclophosphamide
Cyclosporin
Cytarabine
Daffodil
Dichlorophen
Diclofenac sodium
Dinoprost tromethamine
Dopamine
Doxorubicin
Doxycycline
Dieffenbachia
Ethylene glycol

Erythromycin
Glipizide
Glucocorticoids
Glyphosphate
Honeysuckle
Horse chestnut
Hydralazine
Ibuprofen
Indomethacin
Ipecacuanha
Iron/iron salts
Ivermectin
Ketoconazole
Laburnum
Lead
Levamisole
Lignocaine
Loperamide
Medetomidine
Melphalan
Metaldehyde
Methimazole
Metronidazole
Mexiletine
Misoprostol
Mistletoe
Mitotane
Naproxen
Nicotinamide
Nitroscanate
NPK fertilisers
NSAIDs
Paracetamol
Paraquat
Penicillamine
Pentoxifylline
Petroleum distillates
Phenoxy acid herbicides
Phenytoin
Pimobendan

Piperazine
Plastic explosives
Poinsettia
Potassium bromide
Procainamide
Propantheline bromide
Pyracantha
Pyrethrin/pyrethroids
Pyridostigmine
Rhododendron
Rowan
Salt
Selective serotonin reuptake inhibitors
Sildenafil
Sotalol
Strychnine
Sulphasalazine
Terfenadine
Tetracycline
Theobromine
Theophylline
Tricyclic antidepressants
Trimethoprim/sulphonamide
Ursodeoxycholic acid
Vitamin D rodenticides
Xylazine
Yew
Zinc

Endocrine disease, e.g.

Diabetic ketoacidosis*
Hypoadrenocorticism (D)

Gastrointestinal disease

Colitis*
Constipation/obstipation* *q.v.*
Foreign body*
Gastric dilatation/volvulus*
Gastric or duodenal ulceration*
Gastritis/enteritis*

Haemorrhagic gastroenteritis*

Infection, e.g.

- Bacterial*
- Parasites*
- Viral*

Inflammatory bowel disease*

Intestinal volvulus

Intussusception

Neoplasia*

Metabolic/systemic disease

Hypercalcaemia/hypocalcaemia *q.v.*

Hyperkalaemia/hypokalaemia* *q.v.*

Hyperthermia* *q.v.*

Liver disease* *q.v.*

Pancreatitis*

Peritonitis*

Prostatitis*

Pyometra* (D)

Renal disease* *q.v.*

Septicaemia*

Urinary obstruction*

Vestibular disease*

Miscellaneous conditions

Central nervous system disease

Diaphragmatic hernia

Motion sickness*

Psychogenic

CHRONIC VOMITING

Endocrine disease, e.g.

Diabetes mellitus*

Hyperthyroidism* (C)

Hypoadrenocorticism (D)

Gastrointestinal disease

Bacterial overgrowth

Colitis*

Constipation/obstipation* *q.v.*

Enterogastric reflux

Gastric motility disorders*

Gastric or duodenal ulceration*

Gastritis/enteritis*

Infection, e.g.

- Bacterial
- Fungal
- Parasites*
- Viral

Inflammatory bowel disease

- Eosinophilic
- Lymphocytic
- Lymphoplasmacytic
- Mixed

Irritable bowel syndrome

Neoplasia*

- Intestinal, e.g. lymphoma and adenocarcinoma
- Gastrinoma
- Mast cell tumour

Obstruction, e.g.

- Foreign body*
- Inflammatory bowel disease (gastritis or enteritis)
- Intussusception*
- Neoplasia*
- Pyloric stenosis
- Ulceration

Metabolic/systemic disease

Heartworm disease

Hypercalcaemia/hypocalcaemia *q.v.*

Hyperkalaemia/hypokalaemia *q.v.*

Liver disease* *q.v.*

Pancreatitis*

Prostatitis

Pyometra* (D)

Renal disease* *q.v.*

Septicaemia

Miscellaneous conditions

- Abdominal neoplasia
- Diaphragmatic hernia
- Sialadenitis
- Hydrocephalus
- Brain tumour

1.2.6 Diarrhoea

SMALL INTESTINAL DIARRHOEA

Diet

Dietary intolerance, e.g.

- Food hypersensitivity*
- Food intolerance
- Gluten-sensitive enteropathy

Overfeeding

Sudden change in diet

Drugs/toxins (see Large intestinal diarrhoea)

Extra-gastrointestinal disease

- Exocrine pancreatic insufficiency*
- Hepatic disease* *q.v.*
- Hyperthyroidism* (C)
- Hypoadrenocorticism (D)
- IgA deficiency
- Nephrotic syndrome
- Pancreatic duct obstruction
- Pancreatitis*
- Renal disease* *q.v.*
- Right-sided congestive heart failure*
- Systemic lupus erythematosus
- Uraemia

Idiopathic disease

- Lymphangiectasia

Infection

*Bacterial**, e.g.

Campylobacter spp.

Clostridium spp.

E. coli

Salmonella spp.

Staphylococcus spp.

Small intestinal bacterial overgrowth/antibiotic-responsive diarrhoea

Fungal

*Helminths**

Hookworm

Roundworm

Tapeworm

Whipworm

*Protozoal**, e.g.

Cryptosporidiosis

- *Giardia* spp.

Rickettsial

*Viral**, e.g.

Coronavirus

Feline leukaemia virus (C)

Parvovirus

Inflammatory/immune-mediated disease

Basenji enteropathy (D)

Duodenal ulceration

Haemorrhagic gastroenteritis*

Inflammatory bowel disease*

- Eosinophilic
- Granulomatous
- Lymphoplasmacytic

Protein-losing enteropathy and nephropathy of the soft-coated wheaten terrier (D)

Motility disorders, e.g.

Dysautonomia
Enteritis
Functional obstruction (ileus)
Hypoalbuminaemia
Hypokalaemia

Neoplasia*, e.g.

Adenocarcinoma
Carcinoid tumours
Leiomyoma
Lymphoma
Mast cell tumours
Sarcoma

*Partial obstruction**

Foreign body
Intussusception
Neoplasia
Stricture

LARGE INTESTINAL DIARRHOEA**Diet***

Dietary hypersensitivity
Dietary indiscretion

Drugs/toxins

Acetazolamide
Adder bite
Allopurinol
Aminophylline
Amoxicillin
Amphotericin B
Ampicillin
Atenolol
Benzalkonium chloride
Bethanechol
Blue-green algae
Borax

Calcium edetate
Carbamate insecticides
Cardiac glycosides
Cephalexin
Chloramphenicol
Chlorphenamine
Colchicine
Cotoneaster
Cyclophosphamide
Cyclosporin
Cytarabine
Daffodil
Diazoxide
Diclofenac sodium
Dieffenbachia
Doxycycline
Glycophosphate
Honeysuckle
Horse chestnut
Ibuprofen
Indomethacin
Iron/iron salts
Laburnum
Lactulose
Levamisole
Lithium
Loperamide
Mebendazole
Metaldehyde
Methiocarb
Misoprostol
Mistletoe
Mitotane
Naproxen
Nicotinamide
NPK fertilisers
NSAIDs
Organophosphates
Oxytetracycline
Pamidronate

Pancreatic enzyme supplementation
Paracetamol
Paraquat
Pentoxifylline
Petroleum distillates
Phenoxy acid herbicides
Piperazine
Poinsettia
Procainamide
Pyracantha
Pyrethrin/pyrethroids
Pyridostigmine
Quinidine
Rhododendron
Rowan
Salt
Selective serotonin reuptake inhibitors
Sotalol
Theobromine
Theophylline
Vitamin D rodenticides
Yew
Zinc sulphate

Extra-intestinal conditions

Metastatic neoplasia
Neurological disease leading to ulcerative colitis
Pancreatitis
Toxaemia
Uraemia

Idiopathic conditions

Fibre-responsive large-bowel diarrhoea
Irritable bowel syndrome

Infection

*Bacterial**, e.g.

Campylobacter spp.
Clostridium difficile

Clostridium perfringens

E. coli

Salmonella spp.

Yersinia enterocolitica

Fungal, e.g.

Histoplasmosis

Protothecosis

*Parasitic**, e.g.

Amoebiasis

Ancylostoma spp.

Balantidium coli

Cryptosporidiosis

Giardia spp.

Heterobilharzia americana

Roundworm

Tapeworm

Tritrichomonas foetus (C)

Uncinaria spp.

Whipworm

Protozoal, e.g.

Toxoplasmosis

*Viral**

Coronavirus

Feline immunodeficiency virus (C)

Feline infectious peritonitis (C)

Feline leukaemia virus (C)

Parvovirus

Inflammatory/Immune-mediated disease

Histiocytic ulcerative colitis or granulomatous

colitis of boxers (and other breeds) (D)

Inflammatory bowel disease*

Neoplasia*

Benign, e.g.

Adenomatous polyps

Leiomyoma

Malignant, e.g.

Adenocarcinoma
Lymphoma

Obstruction

Caecal inversion
Foreign body*
Intussusception*
Neoplasia
Stricture

Miscellaneous

Secondary to chronic small intestinal disease

Stress

Note: Perirectal diseases, e.g. anal sac disease, anal furunculosis, perineal hernia, rectal prolapse and perianal adenoma, may cause signs mimicking large-bowel disease (tenesmus, haematochezia, mucoid stool).

1.2.7 Melaena

Extra-gastrointestinal disease

Hypoadrenocorticism (D)
Liver disease* *q.v.*
Mastocytosis
Pancreatitis*
Septicaemia*
Shock* *q.v.*
Systemic hypertension* *q.v.*
Uraemia* *q.v.*
Vasculitis, e.g.

- Rocky Mountain spotted fever

Coagulopathy q.v., e.g.

Anticoagulant toxicity* *q.v.*
Congenital clotting factor deficiency *q.v.*
Disseminated intravascular coagulation
Thrombocytopenia *q.v.*
Thrombocytopathia
von Willebrand's disease (D)

Gastrointestinal disease

Enteritis*
Gastritis*
Oesophagitis
Parasites*

*Gastrointestinal ulceration**

Gastrinoma
Helicobacter infection
Inflammatory gastroenteric disease*
Neurological disease
Post foreign body*
Stress
Uraemia* *q.v.*
Drugs, e.g.

- Glucocorticoids*
- NSAIDs*

Ischaemia, e.g.

Mesenteric avulsion
Mesenteric thrombosis/infarction
Mesenteric volvulus
Post gastric dilatation/volvulus* (D)

Neoplasia, e.g.*

Adenocarcinoma
Leiomyoma
Leiomyosarcoma
Lymphoma

Ingestion of blood

Nasal disease (see also Epistaxis), e.g.

Coagulopathy* *q.v.*
Neoplasia*
Trauma*

Oropharyngeal haemorrhage

Coagulopathy* *q.v.*
Neoplasia*
Trauma*

Respiratory disease (see also Haemoptysis), e.g.

Coagulopathy* *q.v.*

Exercise-induced pulmonary haemorrhage

Parasites, e.g. *Angiostrongylus vasorum*

Neoplasia*

Ruptured aneurysm

Trauma*

1.2.8 Haematemesis

Extra-gastrointestinal disease

Hypoadrenocorticism (D)

Liver disease* *q.v.*

Mastocytosis

Pancreatic disease

Septicaemia*

Shock*

Systemic hypertension* *q.v.*

Uraemia* *q.v.*

Coagulopathies q.v., e.g.

Anticoagulant toxicity*

Congenital clotting factor deficiency

Disseminated intravascular coagulation

Thrombocytopenia

Thrombocytopathia

von Willebrand's disease(D)

Toxins, e.g.

Calcipotriol

Paraquat

Vasculitis, e.g.

Rocky Mountain spotted fever

Gastrointestinal disease

Gastritis*

Haemorrhagic gastroenteritis

Oesophagitis

*Gastrointestinal ulceration**

Drugs, e.g.

- NSAIDs
- Glucocorticoids*

Gastrinoma

Helicobacter infection*

Inflammatory gastroenteric disease*

Neurological disease

Post foreign body*

Stress

Systemic mastocytosis

Uraemia*

Ischaemia, e.g.

Post gastric dilatation/volvulus* (D)

Neoplasia, e.g.*

- Adenocarcinoma
- Lymphoma

Ingestion of blood*Nasal disease (see also Epistaxis), e.g.*

Coagulopathy* *q.v.*

Infection, e.g. fungal

Neoplasia*

Trauma*

Oropharyngeal haemorrhage

Coagulopathy* *q.v.*

Neoplasia*

Trauma*

Respiratory disease (see also Haemoptysis), e.g.

Coagulopathy* *q.v.*

Exercise-induced pulmonary haemorrhage

Parasites

Neoplasia*

Ruptured aneurysm

Trauma*

1.2.9 Haematochezia

Drugs

Glucocorticoids

Extra-gastrointestinal disease

Neurological disease leading to ulcerative colitis

Coagulopathies q.v., e.g.

Anticoagulant toxicity*

Congenital clotting factor deficiency *q.v.*

Disseminated intravascular coagulation

Thrombocytopenia *q.v.*

von Willebrand's disease (D)

Perirectal disease, e.g.

Anal furunculosis*

Anal sac disease*

Perianal adenoma*

Perineal hernia*

Rectal prolapse*

Gastrointestinal disease

Algal, e.g.

Protothecosis

Bacterial, e.g.*

Campylobacter spp.

Clostridium spp.

E. coli

Salmonella spp.

Dietary

Dietary hypersensitivity

Dietary indiscretion

Fungal, e.g.

Histoplasmosis

Idiopathic conditions

Fibre-responsive large-bowel diarrhoea

Caecal disease, e.g.

- Typhlitis
- Inversion

Haemorrhagic gastroenteritis

Irritable bowel syndrome

Inflammatory/immune-mediated disease

Histiocytic ulcerative colitis or granulomatous colitis
of boxers (and other breeds) (D)

Inflammatory bowel disease*

Neoplasia

- *Benign*, e.g.
 - Adenomatous polyps
 - Leiomyoma
- *Malignant*, e.g.
 - Adenocarcinoma
 - Lymphoma

Obstructive disease

Foreign body*

Intussusception*

Parasitic*, e.g.

Amoebiasis

Ancylostoma spp.

Balantidium coli

Cryptosporidiosis

Giardia spp.

Heterobilharzia americana

Roundworm

Tapeworm

- Toxoplasmosis

Tritrichomonas foetus (C)

Uncinaria spp.

Whipworm

Viral*

- Coronavirus
- Feline immunodeficiency virus (C)
- Feline infectious peritonitis (C)
- Feline leukaemia virus (C)
- Parvovirus

1.2.10 Constipation/obstipation

Behavioural factors*, e.g.

- Change of daily routine
- Dirty litter box
- Hospitalisation
- Inadequate water intake
- Inadequate exercise
- Novel litter substrate

Congenital conditions

- Atresia ani
- Atresia coli

Diet

- Ingestion of hair, bones and foreign material
- Low-fibre diets

Drugs/toxins

- Aluminium antacids
- Butylscopolamine (hyoscine)
- Diphenoxylate
- Diuretics
- Loperamide
- Opioids
- Propantheline bromide
- Sucralfate
- Verapamil
- Vincristine

Idiopathic conditions

- Idiopathic megacolon*

Neuromuscular disease

Feline dysautonomia (C) (also reported rarely in dogs)

Lumbosacral disease*

Pelvic nerve disease, e.g.

- Traumatic*

Obstructive disease

Intraluminal/intramural

Diverticulum

Foreign body*

Neoplasia*, e.g.

- Adenoma
- Leiomyoma
- Leiomyosarcoma
- Lymphoma

Stricture

Extraluminal

Granuloma

Neoplasia*

Pelvic fracture*

Perineal hernia*

Prostatic disease (D)

- Abscess
- Benign prostatic hypertrophy*
- Neoplasia
- Prostatitis*

Sublumbar lymph node disease

Painful conditions

Anal furunculosis*

Anal or rectal inflammation*

Anal or rectal mass*

Anal or rectal stricture

Anal sac disease*, e.g.

- Abscess
- Anal sacculitis

Orthopaedic disease causing pain and failure to posture

Pelvic trauma (soft tissue or bony)*

Perianal fistula
Proctitis
Spinal cord disease*

Prolonged colonic distension, e.g.

Narrowing of the pelvic canal post fracture*

Systemic disease

Dehydration*
Hypercalcaemia *q.v.*
Hypokalaemia* *q.v.*
Hypothyroidism* (D)
Hyperparathyroidism

1.2.11 Faecal tenesmus/dyschezia

Anal sac disease, e.g.

Abscess/cellulitis
Anal sacculitis*
Impaction
Neoplasia
Stricture

Caudal abdominal mass*

Colorectal disease, e.g.

Colitis *q.u.*
Congenital disease
Foreign body
Large intestinal neoplasia
Megacolon
Polyp
Stricture

Constipation/obstipation *q.v.*

Diet

Excess bone
Excess fibre

Perianal disease, e.g.

- Anal furunculosis/perianal fistulas* (D)
- Perianal adenoma*
- Perineal hernia*
- Rectal prolapse*

Pelvic narrowing**Prostatic disease (D)**

- Abscess
- Benign prostatic hypertrophy*
- Neoplasia
- Paraprostatic cyst
- Prostatitis*

Trauma, e.g.

- Pelvic fracture*

Urogenital disease*, e.g.

- Lower urinary tract disease
- Urethral obstruction

1.2.12 Faecal incontinence

Anal sphincter incompetence

- Myopathy
- Neoplasia*
- Trauma*

Iatrogenic disease, e.g.

- Damage to anal sphincter during anal sacculectomy

Neurological, e.g.

- Cauda equina syndrome
- Degenerative myelopathy/CDRM* (D)
- Distemper encephalomyelitis
- Dysautonomia
- Lumbosacral stenosis
- Myelodysplasia/spinal dysraphism

Peripheral neuropathy
Polyneuropathy
Sacrocaudal dysgenesis
Spinal arachnoid cysts
Spinal trauma

Perianal disease, e.g.

Perianal fistula*
Neoplasia

Reservoir incontinence

Behavioural
CNS disease *q.v.*
Colitis*
Constipation
Diet*
Neoplasia*
Perineal hernia

1.2.13 Flatulence/borborygmus

Aerophagia*

Competitive/aggressive eating
Nervous animal

Diet

High-fibre diets
Milk products/lactase deficiency
Spoiled food

Drugs/toxins, e.g.

Lactulose
Metaldehyde

Maldigestion, e.g.

Exocrine pancreatic insufficiency

Malabsorption, e.g.

Inflammatory bowel disease

1.3 Cardiorespiratory historical signs

1.3.1 Coughing

Drugs/toxins/irritants

Benzalkonium chloride ingestion
Chemical fume inhalation
Potassium bromide (C)
Smoke inhalation

Infection

Bacterial, e.g.

Bordetellosis*
• Mycoplasma

Fungal, e.g.

Coccidioidomycosis

Viral, e.g.

Canine distemper*

Parasitic

Aelurostrongylus abstrusus (C)
Angiostrongylus vasorum (D)
Dirofilaria immitis
Oslerus osleri (D)
Paragonimiasis

Inflammatory/immune-mediated disease

Asthma* (C)
Chronic bronchitis*

Miscellaneous conditions

Aspiration pneumonia
Idiopathic pulmonary fibrosis
Inhaled foreign body
Laryngeal paralysis

Left atrial enlargement*

Lung lobe torsion

Primary ciliary dyskinesia

Neoplasia

Adenocarcinoma

Alveolar carcinoma

Bronchial gland carcinoma

Metastatic disease

Squamous cell carcinoma

Pulmonary haemorrhage

Coagulopathy *q.v.*

Exercise induced

Neoplasia*

Traumatic

- *Angiostrongylus vasorum* (D)

Pulmonary oedema (D)

Airway obstruction

Cardiogenic*

Electrocution

Hypoglycaemia

Hypoproteinaemia *q.v.*

Iatrogenic

Ketamine

Neurological

- Cranial trauma
- Seizures

Obstruction of lymphatic drainage

Primary alveolar–capillary membrane injury

Re-expansion

Strangulation

1.3.2 Dyspnoea/tachypnoea

See Section 2.3.1.

1.3.3 Sneezing and nasal discharge

Anatomical deformities

Acquired nasopharyngeal stenosis
Cleft palate
Oronasal fistula

Congenital disease

Ciliary dyskinesia

Dental disease

Tooth root abscess*

Infection

Bacterial

*Bordetella bronchiseptica**
Chlamydophila spp.*
Coliforms
Mycoplasma spp.
Pasteurella spp.
Staphylococcus spp.
Streptococcus spp.

Fungal

Aspergillosis
Cryptococcosis
Exophiala jeanselmei
Penicillium spp.
Phaeohyphomycosis
Rhinosporidium seeberi

Parasitic

Cuterebra spp.
Eucoleus böehmi
Linguatula serrata
Pneumonyssoides caninum

Viral

Canine distemper virus* (D)
Canine infectious tracheobronchitis* (D)

Feline calicivirus* (C)
Feline herpesvirus* (C)
Feline immunodeficiency virus* (C)
Feline leukaemia virus* (C)
Feline poxvirus
Feline reovirus (C)

Inflammatory disease

Allergic rhinitis*
Granulomatous rhinitis
Lymphoplasmacytic rhinitis*
Nasopharyngeal polyp* (C)

Neoplasia

Adenocarcinoma*
Chondrosarcoma
Fibrosarcoma
Haemangiosarcoma
Lymphoma*
Mast cell tumour
Melanoma
Neuroblastoma
Osteosarcoma
Squamous cell carcinoma*
Transmissible venereal tumour
Undifferentiated carcinomas*

Physical

Foreign body*
Irritant gases
Trauma

Systemic disease (see also Epistaxis)

Coagulopathy *q.v.*
Hypertension *q.v.*
Hyperviscosity syndrome
Vasculitis

- Ehrlichiosis
- Rocky Mountain spotted fever

1.3.4 Epistaxis

Coagulopathies q.v.

Angiostrongylus vasorum infection

Coagulation factor deficiency q.v.

Platelet disease

- Thrombocytopathia q.v.
- Thrombocytopenia q.v.

Miscellaneous conditions

Hypertension q.v.

Hyperviscosity syndrome e.g.

- Hyperlipidaemia,
- Polycythaemia

Increased capillary fragility

Thromboembolism

Nasal disease

Dental disease

Oronasal fistula

Tooth root abscess*

Infection

Bacterial

- *Mycoplasma* spp.*
- *Pasteurella* spp.*

Fungal

- Aspergillosis
- *Cryptococcus* spp.
- *Exophiala jeanselmei*
- *Penicillium* spp.
- Phaeohyphomycosis
- *Rhinosporidium seeberi*

Parasitic

- *Cuterebra*
- *Eucoleus böehmi*
- *Linguatula serrata*
- *Pneumonyssoides caninum*

Viral

- Canine distemper virus* (D)
- Canine infectious tracheobronchitis* (D)
- Feline calicivirus* (C)
- Feline herpesvirus* (C)
- Feline immunodeficiency virus* (C)
- Feline leukaemia virus* (C)

Inflammatory disease

Allergic rhinitis*

Lymphoplasmacytic rhinitis*

Neoplasia

Adenocarcinoma*

Chondrosarcoma

Fibrosarcoma

Haemangiosarcoma

Lymphoma*

Mast cell tumour

Melanoma

Osteosarcoma

Squamous cell carcinoma*

Transmissible venereal tumour

Undifferentiated carcinomas*

Physical

Trauma*

1.3.5 Haemoptysis

Cardiovascular disease

Arteriovenous fistula

Bacterial endocarditis

Dirofilaria immitis (D)

Pulmonary oedema* *q.v.*

Iatrogenic

Diagnostic procedures, e.g.

- Bronchoalveolar lavage
- Bronchoscopy

- Lung aspirate
 - Trans-tracheal wash
- Endotracheal intubation*

Pulmonary disease

Pulmonary hypertension
Pulmonary thromboembolism

Infection

Bacterial

- Nocardiosis
- Pneumonia*
- Pulmonary abscessation

Fungal

- Blastomycosis
- Coccidioidomycosis
- Histoplasmosis

Parasitic

- *Aelurostrongylus abstrusus* (C)
- *Angiostrongylus* (D)
- *Capillaria aerophila*
- *Dirofilaria immitis* (D)
- *Paragonimus kellicotti*

Viral

- Infectious tracheobronchitis*

Inflammatory

Bronchiectasis
Bronchopneumonia
Chronic bronchitis* (D)
Pulmonary infiltrate with eosinophils

Neoplastic

Adenocarcinoma
Chondrosarcoma
Metastatic tumours*
Squamous cell carcinoma

Physical

Abscess
Bronchial gland carcinoma

- Foreign body
- Lung lobe torsion
- Trauma, e.g.
 - Pulmonary contusions

Systemic disease

- Coagulation factor deficiency *q.v.*
- Thrombocytopathia *q.v.*
- Thrombocytopenia *q.v.*

1.3.6 Exercise intolerance

Cardiovascular disease, (see Section 1.1.7) e.g.

- Arrhythmias
- Congestive heart failure*
- Cyanotic heart disease *q.v.*
- Myocardial dysfunction
- Obstruction to ventricular outflow

Drugs, e.g.

- Drugs causing hypotension

Metabolic/endocrine disease, e.g.

- Anaemia*
- Hyperthyroidism* (C)
- Hypoadrenocorticism (D)
- Hypoglycaemia *q.v.*
- Hypokalaemic polymyopathy
- Hypothyroidism* (D)
- Malignant hyperthermia

Neuromuscular/musculoskeletal disease, e.g.

- Botulism
- Cervical myelopathy (D)
- Coonhound paralysis
- Ischaemic neuromyopathy* (C)
- Intermittent claudication
- Lumbosacral pain
- Myasthenia gravis

Myopathies

- Congenital
- Hypokalaemic
- Toxic

Peripheral neuropathy *q.v.*

Polyarthritis

Polymyositis

Protozoal myositis

Tick paralysis

Respiratory disease *q.v.*, e.g.

Idiopathic pulmonary fibrosis

Pleural effusion*

Pulmonary oedema*

Upper airway obstruction *q.v.*

1.4 Dermatological historical signs

1.4.1 Pruritus

Drugs/toxins

Methimazole

Paracetamol

Endocrine disorders

Calcinosis cutis*

Hyperthyroidism* (C)

Predisposing to pyoderma

- Hyperadrenocorticism
- Hypothyroidism* (D)

Environmental

Contact irritant dermatitis*

Sunburn/solar dermatitis*

Immune-mediated disease

Drug eruptions

Discoid lupus erythematosus

Systemic lupus erythematosus

Allergy/hypersensitivity

- Atopy*
- Contact allergy*
- Food hypersensitivity*
- Hormonal hypersensitivity (D)
- Parasite hypersensitivity*, e.g.
 - Fleas
 - Mosquitoes

Pemphigus complex

- Pemphigus erythematosus
- Pemphigus foliaceus
- Pemphigus vegetans
- Pemphigus vulgaris
- Bullous pemphigoid

Infection*Bacterial*

- Deep pyoderma*
- Surface pyoderma/acute moist dermatitis (wet eczema*)
- Superficial bacterial folliculitis*

Fungal

- Candidiasis
- Dermatophytosis*
- Malassezia* dermatitis*
- Pythiosis

Parasitic

- Cheyletiellosis
- Demodicosis*
- Dermanyssus gallinae*
- Dirofilariasis
- Dracunculiasis
- Fleas*
- Hookworm dermatitis
- Lynxacarus radovskyi* (C)
- Notoedres cati* (C)
- Otobius megnini* (D)
- Otodectes cynotis*
- Pediculosis
- Pelodera* dermatitis

Pneumonyssoides caninum (D)

Sarcoptic mange* (D)

Schistosomiasis

Trombiculiasis*

Keratinisation disorders

Acne*

Idiopathic facial dermatitis

Primary seborrhoea

Vitamin A-responsive dermatosis

Miscellaneous

Feline hypereosinophilic syndrome (C)

Idiopathic sterile granulomatous dermatitis

Sterile eosinophilic pustulosis

Subcorneal pustular dermatosis

Urticaria pigmentosa

Waterline disease of black Labradors (D)

Zinc-responsive dermatosis

Neoplasia

Cutaneous T cell lymphoma

Mast cell tumour*

Mycosis fungoides

Other neoplasia with secondary pyoderma

Paraneoplastic pruritus

Neurological, e.g.

Syringohydromyelia

1.5 Neurological historical signs

1.5.1 Seizures

INTRACRANIAL

Congenital

Ceroid lipofuscinosis

Chiari-like malformation

Cortical dysplasia

- Hydrocephalus
- Intracranial arachnoid cysts
- Lissencephaly
- Lysosomal storage diseases
- Organic acidurias, e.g.
 - L-2-hydroxyglutaricaciduria

Idiopathic*

Infectious

Bacterial, e.g.

- Nocardiosis
- Pasteurella* spp.
- Staphylococcus* spp.

Fungal

- Aspergillosis
- Blastomycosis
- Coccidioidomycosis
- Cryptococcosis
- Histoplasmosis
- Mucormycosis

Parasitic

- Aberrant migration of *Cuterebra* spp.
- Dirofilariasis

Protozoal, e.g.

- Neosporosis (D)
- Toxoplasmosis

Rickettsial encephalitis

- Ehrlichiosis/anaplasmosis
- Rocky Mountain spotted fever

Viral

- Canine distemper* (D)
- Canine herpesvirus (D)
- Eastern equine encephalitis
- Feline immunodeficiency virus* (C)

Feline infectious peritonitis* (C)
Feline leukaemia virus* (C)
Pseudorabies
Rabies

Inflammatory/immune-mediated disease

Breed-specific necrotising meningoencephalitis
Distemper vaccine associated (D)
Eosinophilic meningoencephalitis
Granulomatous meningoencephalomyelitis* (D)
Steroid-responsive meningoencephalitis

Neoplasia

Local extension

Middle-ear tumour
Nasal/paranasal sinus tumour
Pituitary tumour
Skull tumour

Metastatic, e.g.

Haemangiosarcoma
Lymphoma
Malignant melanoma
Mammary carcinoma
Prostatic carcinoma
Pulmonary carcinoma
Teratoma

Primary intracranial

Astrocytoma
Choroid plexus tumours
Ependymoma
Ganglioblastoma
Glioma
Medulloblastoma
Meningioma
Neuroblastoma
Oligodendrogioma

Physical

Trauma

Vascular

Haemorrhage, e.g.

Angiostrongylus vasorum

Coagulopathy q.v.

Feline ischaemic encephalopathy (C)

Hypertension q.v.

Trauma

Infarction, e.g.

Thromboembolism

EXTRACRANIAL**Drugs/toxins**

Alphachloralose

Arsenic

Baclofen

Blue-green algae

Borax

Cannabis

Carbamate

Doxapram

Ethylene glycol

Glyphosphate

Honeysuckle

Hymenoptera stings

Ibuprofen

Iodine-containing myelographic contrast media

Laburnum

Lead

Lignocaine

Metaldehyde

Metronidazole

Mexitetine

Mistletoe

Organophosphates

Paracetamol

Petroleum distillates
Phenoxy acid herbicides
Piperazine
Plastic explosives
Pyrethrin/pyrethroids/permethrin
Risperidone
Salt
Selective serotonin reuptake inhibitors
Strychnine
Terfenadine
Theobromine
Theophylline
Tricyclic antidepressants
Vitamin D rodenticides
Yew

Metabolic

Electrolyte imbalances*, e.g.

- Hypernatraemia *q.v.*
- Hypocalcaemia *q.v.*
- Hyponatraemia *q.v.*

Hepatic encephalopathy* *q.v.*

- Hypoglycaemia *q.v.*
- Renal disease* *q.v.*

Nutritional

Thiamine deficiency

1.5.2 Trembling/shivering

Drugs/toxins

5-Fluorouracil
Baclofen
Benzodiazepines
Blue-green algae
Bromethalin
Caffeine
Carbamate

Guarana
Hexachlorophene
Horse chestnut
Ivermectin
Macadamia nuts
Metaldehyde
Mexiletine
Mycotoxins
Risperidone
Organochlorines
Organophosphates
Petroleum distillates
Plastic explosives
Piperazine
Pyrethrin/pyrethroids/permethrin
Rhododendron
Salbutamol
Salt
Strychnine
Terbutaline
Theobromine
Theophylline
Tricyclic antidepressants
Yew
Zinc phosphate

Metabolic

Hepatic encephalopathy *q.v.**
Hyperadrenocorticism/hypoadrenocorticism (D)
Hyperkalaemia *q.v.*
Hypocalcaemia *q.v.*
Hypoglycaemia *q.v.*
Primary hyperparathyroidism
Uraemia *q.v.**

Neurological

Abiotrophies
Cerebellar disease *q.v.*
Central nervous system inflammatory disease
Cerebrospinal hypomyelinogenesis and dysmyelinogenesis
Corticosteroid responsive tremor syndrome ('white dog shaker disease')

Idiopathic head nod of Dobermanns and bulldogs
Lumbosacral disease, e.g.

- Disc herniation
- Discospondylitis
- Neoplasia
- Stenosis

Lysosomal storage disease
Neuroaxonal dystrophy (D)
Nerve root compression
Niemann–Pick disease (C)
Peripheral neuropathies *q.v.*
Primary orthostatic tremor
Senility
Spongiform encephalopathy

Physiological

Ballistocardiographic*
Fatigue/weakness*
Fear*
Reduced environmental temperature*

1.5.3 Ataxia

FOREBRAIN

Congenital

Dandy–Walker syndrome
Hydrocephalus
Intra-arachnoid cyst

Degenerative

Leukodystrophy
Lysosomal storage disease
Mitochondrial encephalopathy
Multi-system neuronal degeneration
Spongy degeneration

Immune-mediated disease/infection

Encephalitis *q.v.*
Feline spongiform encephalopathy

Metabolic

- Electrolyte/acid-base disorders *q.v.**
- Hepatic encephalopathy *q.v.**
- Hypoglycaemia *q.v.*
- Uraemic encephalopathy *q.v.**

Neoplasia

- Choroid plexus tumours
- Dermoid cyst
- Ependymoma
- Epidermoid cyst
- Glioma
- Lymphoma
- Medulloblastoma
- Meningioma
- Metastatic tumour

Vascular

- Cerebrovascular accident

BRAINSTEM/CENTRAL VESTIBULAR DISORDERS**Congenital**

- Chiari-like malformation
- Hydrocephalus
- Intra-arachnoid cysts

Degenerative

- Lysosomal storage disorders

Drugs

- Metronidazole

Immune mediated/infectious

- Feline spongiform encephalopathy (C)
- Meningoencephalitis *q.v.*

Metabolic

- Electrolyte abnormalities* *q.v.*
- Hepatic encephalopathy* *q.v.*
- Uraemic encephalopathy* *q.v.*

Neoplastic

Choroid plexus tumours
Dermoid cyst
Epidermoid cyst
Glioma
Lymphoma
Medulloblastoma
Meningioma
Metastatic tumour

Nutritional

Thiamine deficiency

Trauma**Vascular**

Cerebrovascular accident

CEREBELLUM (generally ataxia without conscious proprioceptive deficits)

Congenital

Feline cerebellar hypoplasia (C)

Degenerative

Cerebellar cortical degeneration
Gangliosidosis
Hereditary ataxia of Jack Russell and smooth-coated fox terriers (D)
Leukoencephalomalacia (D)
Neuroaxonal dystrophy (D)
Neuronal vacuolation and spinocerebellar degeneration (D)
Storage diseases

Drugs/toxins

Heavy metals
Organophosphates

Immune mediated/infectious q.v.

In utero infection with feline parvovirus (C)

Metabolic

Thiamine deficiency

Neoplastic

Choroid plexus tumours
Dermoid cyst
Epidermoid cyst
Glioma
Lymphoma
Medulloblastoma
Meningioma
Metastatic tumour

Vascular

Cerebrovascular accident *q.v.*

PERIPHERAL VESTIBULAR DISEASE**Congenital**

Lymphocytic labyrinthitis
Non-inflammatory cochlear degeneration

Drugs/toxins

Aminoglycosides
Chlorhexidine
Topical iodophors

Idiopathic

Canine geriatric vestibular disease
Feline idiopathic vestibular disease

Immune mediated/infectious

Nasopharyngeal polyps*
Otitis media/interna*

- Primary secretory otitis media in the Cavalier King Charles Spaniel
- Secondary to otitis externa

Metabolic

Hypothyroidism* (D)

Neoplastic

Middle- or inner-ear tumours, e.g.

- Adenocarcinoma
- Chondrosarcoma
- Fibrosarcoma
- Lymphoma
- Osteosarcoma
- Squamous cell carcinoma

Traumatic

SPINE

Congenital

- Atlanto-occipital dysplasia
- Atlantoaxial subluxation
- Cartilaginous exostoses
- Dermoid sinus
- Epidermoid cyst
- Hereditary myelopathy
- Meningocele
- Sacral osteochondritis dissecans
- Sacrocaudal dysgenesis
- Spina bifida
- Spinal arachnoid cyst
- Spinal dysraphism
- Syringohydromyelia (D)
- Tethered cord syndrome
- Vertebral malformations *q.v.*

Degenerative

- Cervical fibrotic stenosis
- Cervical spondylomyelopathy
- Degenerative disc disease* (D)
- Degenerative myelopathy*
- Leukoencephalomalacia
- Lumbosacral disease
- Lysosomal storage disease
- Neuroaxonal dystrophy
- Neuronal vacuolation and spinocerebellar degeneration (D)

Other leukodystrophies
Synovial cysts

Idiopathic

Calcinosis circumscripta
Disseminated idiopathic skeletal hyperostosis

Immune mediated

Cauda equina neuritis
Granulomatous meningoencephalomyelitis*
Steroid-responsive meningitis–arteritis

Infectious

Discospondylitis
Foreign body
Meningomyelitis
Spinal epidural empyema

Neoplastic

Extradural
Chondrosarcoma
Fibrosarcoma
Haemangiosarcoma
Lipoma
Lymphoma
Malignant nerve sheath tumour
Meningioma
Metastatic disease
Myeloma
Osteosarcoma

Intradural extramedullary
Malignant nerve sheath tumour
Meningioma
Metastatic

Intramedullary
Astrocytoma
Ependymoma

Metastatic tumour
Oligodendrogloma

Nutritional

Hypervitaminosis A
Thiamine deficiency

Traumatic

Brachial plexus avulsion
Dural tear
Fracture*
Gunshot wound
Luxation*
Sacrocaudal injury
Traumatic disc injury*

Vascular

Fibrocartilaginous embolism*
Fat-graft necrosis
Myelomalacia
Spinal cord haematoma
Spinal cord haemorrhage
Vascular anomaly

PERIPHERAL NERVES (mono- or polyneuropathies)

Degenerative

Birman cat distal polyneuropathy (C)
Boxer dog progressive axonopathy (D)
Giant axonal neuropathy of German shepherds (D)
Globoid cell leukodystrophy
Golden retriever hypomyelinating polyneuropathy (D)
Hereditary/idiopathic polyneuropathy of Alaskan malamutes (D)
Hypertrophic neuropathy
Hypomyelinating polyneuropathy
Laryngeal paralysis–polyneuropathy complex
Lysosomal storage diseases

- Fucosidosis (D)
- Globoid cell leukodystrophy
- Glycogen storage disease type IV
- Niemann–Pick disease (C)

Mucopolysaccharidosis IIIA (D)
Sensory neuropathy (D)

Immune mediated/infectious

Chronic inflammatory demyelinating polyneuropathy
Feline leukaemia virus associated
Polyradiculoneuritis
Protozoal
Sensory ganglioradiculoneuritis

Neoplastic

Lymphoma
Malignant nerve sheath tumours
Myelomonocytic neoplasia
Paraneoplastic neuropathy

Traumatic

Bite wounds*
Iatrogenic
Missile injuries
Traction injuries

Vascular

Ischaemic neuromyopathy*
Neurogenic claudication

SYSTEMIC

Drugs/toxins

Alphachloralose
Baclofen
Benzodiazepines
Blue-green algae
Butorphanol
Cannabis
Carbamate
Codeine
Daffodil
Dichlorophen
Diclofenac

Ethylene glycol toxicity
Fentanyl and other sedatives and tranquillisers
Glyphosphate
Horse chestnut
Ivermectin
Loperamide
Metaldehyde
Methiocarb
Metronidazole
Naproxen
Nitroscanate (C)
Organophosphates
Paracetamol
Paraquat
Phenobarbitone
Phenoxy acid herbicides
Phenytoin
Piperazine
Plastic explosives
Potassium bromide
Primidone
Pyridoxine (Vitamin B6)
Selective serotonin reuptake inhibitors
Terfenadine
Thallium
Theobromine
Tricyclic antidepressants
Vincristine
Walker Hound mononeuropathy
Yew

Metabolic

Electrolyte/acid–base disorders*
Endocrine disease, e.g.

- Diabetes mellitus*
- Hypothyroidism* (D)

Hepatic encephalopathy*
Hyperadrenocorticoid neuropathy
Hyperchylomicronaemia
Insulinoma/hypoglycaemia

Nutritional

Vitamin B6 (pyridoxine) overdose

1.5.4 Paresis/paralysis**SPINAL DISEASE****Congenital**

Atlantoaxial subluxation
Atlanto-occipital dysplasia
Cartilaginous exostoses
Dermoid sinus
Epidermoid cyst
Hereditary myelopathy
Meningoceles
Osteochondromatosis
Sacrocaudal dysgenesis
Sacral osteochondritis dissecans
Spina bifida
Spinal arachnoid cyst
Spinal dysraphism
Syringohydromyelia (D)
Vertebral malformations *q.v.*

Degenerative

Afghan hound hereditary myelopathy (D)
Calcinosis circumscripta
Cervical spondylomyelopathy
Degenerative disc disease* (D)
Degenerative myelopathy* (D)
Labrador retriever axonopathy (D)
Lumbosacral disease
Lysosomal storage disease
Neuronal vacuolation and spinocerebellar degeneration (D)
Rottweiler leukoencephalomyelopathy (D)
Other leukodystrophies
Synovial cysts

Idiopathic

Calcinosis circumscripta
Disseminated idiopathic skeletal hyperostosis

Immune mediated

- Cauda equina neuritis
- Epidural granuloma
- Granulomatous meningoencephalomyelitis*
- Steroid-responsive meningitis–arteritis

Infectious

- Discospondylitis
- Infectious meningoencephalomyelitis
- Spinal epidural empyema

Neoplastic*Extradural*

- Chondrosarcoma
- Fibrosarcoma
- Haemangiosarcoma
- Lipoma
- Lymphoma
- Malignant nerve sheath tumour
- Meningioma
- Metastatic
- Multiple myeloma
- Osteosarcoma
- Plasma cell tumour

Intradural extramedullary

- Malignant nerve sheath tumour
- Meningioma
- Metastatic

Intramedullary

- Astrocytoma
- Ependymoma
- Metastatic tumour
- Oligodendrogloma

Nutritional

- Hypervitaminosis A
- Thiamine deficiency

Traumatic

Brachial plexus avulsion
Dural tear
Foreign body
Fracture*
Gunshot wound
Luxation*
Sacrocaudal injury
Traumatic disc injury*

Vascular

Fibrocartilaginous embolism*
Fat-graft necrosis
Ischaemic neuromyopathy*
Myelomalacia
Neurogenic claudication
Spinal cord haematoma
Spinal cord haemorrhage
Vascular anomaly

PERIPHERAL NERVES (mono- or polyneuropathies)**Degenerative**

Adult-onset motor neurone disease
Birman cat distal polyneuropathy (C)
Boxer dog progressive axonopathy (D)
Distal denervating disease (D)
Giant axonal neuropathy of German shepherds (D)
Golden retriever hypomyelinating polyneuropathy (D)
Hereditary/idiopathic polyneuropathy of Alaskan malamutes (D)
Hypertrophic neuropathy
Idiopathic polyneuropathy
Laryngeal paralysis–polyneuropathy complex
Lysosomal storage diseases

- Fucosidosis (D)
- Globoid cell leukodystrophy
- Glycogen storage disease type IV
- Niemann–Pick disease (C)

Mucopolysaccharidosis IIIA (D)
Rottweiler distal sensorimotor polyneuropathy (D)

Sensory neuropathy of long-haired dachshunds (D)
Spinal muscular atrophy

Drugs/toxins

Baclofen
Blue-green algae
Cannabis
Daffodil
Horse chestnut
Ivermectin
Methiocarb
Organophosphate
Petroleum products
Phenoxy acid herbicides
Pyrethrin/pyrethroids
Salinomycin toxicity (C)
Thallium
Vincristine
Vitamin K antagonists
Walker hound mononeuropathy (D)

Immune mediated/infectious

Acute idiopathic polyradiculoneuritis (coonhound paralysis in the USA) (D)
Brachial plexus neuritis
Chronic inflammatory demyelinating polyneuropathy
Protozoal polyradiculoneuritis
Sensory ganglioradiculoneuritis

Metabolic

Diabetic neuropathy*
Hyperchylomicronaemia
Hypothyroid neuropathy*
Primary hyperoxaluria

Neoplastic

Insulinoma
Lymphoma
Malignant nerve sheath tumours
Myelomonocytic neoplasia
Paraneoplastic neuropathy, e.g. lymphoma

Traumatic

Bite wounds*
Iatrogenic
Missile injuries
Traction injuries

Vascular

Arterial thromboembolism
Ischaemic neuromyopathy*
Traumatic ischaemic neuromyopathy associated with bottom-hung pivot windows and garage doors

1.5.5 Coma/stupor

INTRACRANIAL DISEASE

(Note: Especially lesions of the midbrain through the medulla that impair the ascending reticular activating system)

Congenital

Hydrocephalus

Degenerative

Inherited neurodegenerative diseases

- Multi-system neuronal degeneration of cocker spaniels (D)
- Multi-systemic chromatolytic neuronal degeneration
- Spongiform degenerations

Inflammatory/infectious q.v.**Neoplastic***Local extension*

Nasal tumour
Skull osteochondroma

Metastatic

Carcinoma
Haemangiosarcoma

Primary

Choroid plexus papilloma
Glioma
Lymphoma
Meningioma
Pituitary tumour

Trauma

Head trauma
Intracranial haemorrhage
Subdural haematoma

Vascular

Cerebrovascular accident
Feline ischaemic encephalopathy (C)
Hypertension *q.v.*
Intracranial haemorrhage

EXTRACRANIAL DISEASE**CNS perfusion disturbances**

Anaemia (severe/acute)* *q.v.*
Cardiorespiratory disease*
Haemoglobin-related toxicity
Hyperviscosity
Hypovolaemia (severe/acute)*

Drugs/toxins

Alphachloralose
Baclofen
Barbiturates
Benzodiazepines and other sedatives/anaesthetic agents
Blue-green algae
Borax
Cannabis
Carbamate insecticides
Diclofenac sodium
Ethylene glycol
Ibuprofen
Indomethacin

Iron
Ivermectin
Lead
Loperamide
Metaldehyde
Methiocarb
Metronidazole
Naproxen
Organophosphates
Paracetamol
Phenoxy acid herbicides
Salt
Tricyclic antidepressants
Vitamin K antagonists
Water
Xylitol
Yew

Metabolic

Electrolyte disturbances* *q.v.*
Hepatic encephalopathy*
Hypoglycaemia *q.v.*
Hypothyroid myxoedema coma
Uraemic encephalopathy *q.v.*

Nutritional

Thiamine deficiency

1.5.6 Altered behaviour: General changes

(E.g. disorientation, increased aggression, and loss of normal behaviour)

INTRACRANIAL DISEASE

Congenital

Hydrocephalus
Lissencephaly
Lysosomal storage diseases

Degenerative

Cognitive dysfunction

Drugs/toxins

Acepromazine
Benzodiazepines
Other sedatives/tranquillisers
Cannabis
Ibuprofen
Ivermectin
Petroleum distillates
Phenylpropanolamine
Risperidone
Salbutamol
Selective serotonin reuptake inhibitors
Selegiline
Terfenadine

Infectious

Bacterial

Fungal

Prion

Feline spongiform encephalopathy

Protozoal

Neosporosis
Toxoplasmosis

Viral

Canine distemper* (D)
Feline immunodeficiency virus* (C)
Feline infectious peritonitis* (C)
Feline leukaemia virus* (C)

Inflammatory/immune mediated

Granulomatous meningoencephalitis
Meningoencephalitis of unknown origin
Necrotising meningoencephalitis

Neoplastic, e.g.

Glioma
Lymphoma
Meningioma
Metastatic disease
Pituitary

Physical

Trauma

EXTRACRANIAL DISEASE**Metabolic**

Hepatic encephalopathy *q.v.*
Hypocalcaemia *q.v.*
Hypoglycaemia *q.v.*
Renal disease *q.v.*
Thiamine deficiency

1.5.7 Altered behaviour: Specific behavioural problems**Aggression**

Dominance*
Fear*
Hypocholesterolaemia
Petting*
Play*
Possessive*
Predatory*
Territorial*

Inappropriate urination and defecation

Cognitive dysfunction
Fear
Gastrointestinal disease *q.v.*
Hyperexcitability
Litter box related

- Dirty litter

- New location of the litter box
- Unfamiliar litter

Separation anxiety

Territorial marking

Urinary tract disease (see Incontinence/inappropriate urination)

Stereotypy/compulsive behaviour

Boredom*

Frustration*

Genetic predisposition*

Physical triggers, e.g.

- Anal sac disease (tail chasing)*
- Dermatitis in over-grooming*

Neurological disease

- Brainstem lesions *q.v.*
- Forebrain disease *q.v.*
- Lumbosacral disease (tail chasing)
- Seizures* *q.v.*
- Sensory neuropathies (self-mutilation)
- Vestibular lesions (circling)* *q.v.*

Stress*

1.5.8 Deafness

Congenital conditions

Aplasia/hypoplasia of auditory receptors

Hydrocephalus

Degenerative disease

Presbycusis/age-related hearing loss*(D)

- Cochlear conductive defects
- Senile ossicle or receptor degeneration

Drugs/toxins

Antibiotics

Aminoglycosides

Amphotericin B

Ampicillin

Bacitracin
Chloramphenicol
Colistin
Erythromycin
Griseofulvin
Hygromycin B
Minocycline
Polymyxin B
Tetracyclines
Vancomycin

Antiseptics

Benzalkonium chloride
Benzethonium chloride
Cetrimide
Chlorhexidine
Ethanol
Iodine
Iodophors

Cancer chemotherapeutics

Actinomycin
Cisplatin
Cyclophosphamide
Vinblastine
Vincristine

Diuretics

Bumetanide
Ethacrynic acid
Furosemide

Metals/heavy metals

Arsenic
Gold salts
Lead
Mercury
Triethyl/trimethyl tin

Miscellaneous

Ceruminolytic agents
Danazol

Detergents
Digoxin
Dimethyl sulphoxide
Diphenylhydrazine
Insulin
Potassium bromide
Prednisolone
Propylene glycol
Quinidine
Salicylates

Idiopathic

Infection/inflammation

Otitis externa* *q.v.*
Otitis interna*
Otitis media*

Mechanical

Loud noise
Trauma

Neoplasia

Intracranial
Middle ear
Nasopharyngeal polyp*

1.5.9 Multifocal neurological disease

Congenital

Hydrocephalus
Syringohydromyelia

Degenerative

Mitochondrial encephalopathies
Organic acidurias
Storage diseases

Drugs/toxins

Alphachloralose

Baclofen
Benzodiazepines
Blue-green algae
Borax
Cannabis
Carbamate
Daffodil
Dichlorophen
Diclofenac sodium
Ethylene glycol
Glyphosphate
Horse chestnut
Ibuprofen
Ivermectin
Laburnum
Loperamide
Metaldehyde
Methiocarb
Naproxen
Organophosphates
Paracetamol
Petroleum products
Piperazine
Plastic explosives
Pyrethrin/pyrethroids
Rhododendron
Salbutamol
Salt
Selective serotonin reuptake inhibitors
Terfenadine
Theobromine
Tricyclic antidepressants
Vitamin D2/D3
Vitamin K antagonists
Yew

Idiopathic conditions

Dysautonomia

Immune-mediated disease

Granulomatous meningoencephalomyelitis

Necrotising encephalitis
Spinal cord vasculitis
Steroid-responsive meningitis–arteritis

Infectious

Bacterial

Bacterial encephalitis/meningitis
Tetanus

Fungal

Aspergillosis
Blastomycosis
Candidiasis
Coccidioidomycosis
Cryptococcosis

Parasitic

Cuterebra spp.
Toxocariasis

Protozoal

Neosporosis
Toxoplasmosis

Rickettsial

Ehrlichiosis/anaplasmosis
Protothecosis
Rocky Mountain spotted fever

Viral

Canine distemper virus (D)*
Feline immunodeficiency virus* (C)
Feline infectious peritonitis* (C)
Feline leukaemia virus* (C)
Herpesvirus
Parainfluenza virus
Parvovirus*

Metabolic

Hepatic disease* *q.v.*

Hyperosmolarity
Hypoglycaemia *q.v.*
Hypothyroidism* (D)
Renal disease* *q.v.*

Neoplastic

Leukaemia
Lymphoma
Metastatic neoplasia

Nutritional

Thiamine deficiency

Vascular

Intracranial and/or spinal haemorrhage

- *Angiostrongylus vasorum*
- Coagulopathy
- Trauma
- Vascular anomaly

Hypertension *q.v.*
Thromboembolism

1.6 Ocular historical signs

1.6.1 Blindness/visual impairment

CENTRAL NERVOUS SYSTEM (CNS)

Brain disease

Congenital, e.g.
Hydrocephalus

Degenerative, e.g.
Neuronal ceroid lipofuscinosis
Lysosomal storage diseases

Drugs/toxins, e.g.
Ivermectin/moxidectin
Lead

Levamisole
Metaldehyde

Immune mediated/infectious, e.g.

Granulomatous meningoencephalomyelitis
Toxoplasmosis

Metabolic, e.g.

Hepatic encephalopathy *q.v.*

Neoplastic, e.g.

Lymphoma
Meningioma
Pituitary tumour

Trauma

Vascular, e.g.

Cerebrovascular accident

Optic nerve disease, e.g.

Optic nerve hypoplasia/aplasia
Optic neuritis
Space-occupying lesion compressing the optic nerve
Trauma

INTRAOCULAR/PERIOCULAR

Acquired

Anterior uveitis
Cataract* *q.v.*
Chorioretinitis
Chronic superficial keratitis/pannus*
Chronic uveitis*
Corneal lipid dystrophy/degeneration
Corneal oedema and endothelial dysfunction*
Endophthalmitis
Entropion
Generalised progressive retinal degeneration
Glaucoma*

Hypertensive ocular disease*

Hyphaema

Intraocular haemorrhage*

Keratoconjunctivitis sicca*

Nutritional retinal degeneration

- Taurine deficiency
- Vitamin A deficiency
- Vitamin E deficiency

Phthisis bulbi, e.g.

- Secondary to ocular trauma or chronic uveitis

Pigmentary keratitis

Retinal degeneration

Retinal detachment* *q.v.*

Retinal haemorrhage

Retinal pigment epithelial cell dystrophy

Sudden acquired retinal degeneration

Superficial keratitis

Symblepharon

Trauma*

Ulcerative keratitis and corneal scarring

Vitreal haemorrhage

*Sequelae to chronic uveitis**

Corneal oedema

Cyclitic membranes

Exudative retinal detachment

Hyphaema

Intraocular adhesions

Lens luxation

Phthisis bulbi

Secondary cataracts

Secondary glaucoma

Secondary retinal degeneration*

Congenital

Ankyloblepharon

Anophthalmia

Anterior segment dysgenesis

Collie eye anomaly

Congenital vitreous opacification

Corneal dermoid
Entropion (severe)
Microphthalmia
Persistent hyperplastic primary vitreous
Persistent hyperplastic tunica vasculosa lentis
Persistent pupillary membranes
Posterior segment coloboma
Vitreo-retinal dysplasia

Lens disorders

Aphakia
Cataracts
Coloboma
Lenticonus/lentiglobus
Microphakia
Spherophakia

Retinal disorders

Congenital retinal dystrophy
Early-onset photoreceptor dystrophies

- Early retinal degeneration
- Photoreceptor dysplasia
- Rod–cone dysplasia
- Rod dysplasia

Hemeralopia
Lysosomal storage diseases
Primary retinal dysplasia
Secondary retinal dysplasia

- Idiopathic/inherited
- Intrauterine trauma
- Maternal infections
- Radiation
- Vitamin A deficiency during pregnancy

1.6.2 Epiphora/tear overflow

Impaired tear drainage
Dacryocystitis
Entropion

Imperforate/obstructed punctum
or canaliculus
Lacrimal canalicular aplasia
Small lacrimal lakes

Painful/irritating ocular conditions

Extraorbital conditions

Diseases of paranasal sinuses
Mechanical or olfactory stimulation
of the nasal mucosa

*Eyelid conditions**

Blepharitis
Distichiasis/ectopic cilia
Entropion
Facial nerve paralysis
Lid laceration
Neoplasia
Trichiasis

Intraocular conditions

Acute uveitis
Anterior lens luxation (D)
Glaucoma
Trauma

Ocular surface conditions

Conjunctivitis*
Corneal ulceration*
Foreign body
Keratitis*

*Third eyelid conditions**

Lymphoid hyperplasia
Neoplasia
Prolapsed nictitans gland
Scrolled third eyelid
Trauma

1.7 Musculoskeletal historical signs

1.7.1 Forelimb lameness

YOUNG ANIMALS

Any site

- Infection*
- Metaphyseal osteopathy
- Panosteitis
- Trauma*
 - Bruising or strain of soft tissues*
 - Laceration*
 - Penetrating wound*

Shoulder

- Brachial plexus avulsion
- Fracture of the humerus*
- Fracture of the scapula
- Haemarthrosis
- Joint capsule rupture
- Luxation (congenital or acquired)
- Medially displaced biceps tendon
- Osteochondrosis* (D)
- Septic arthritis*
- Shoulder dysplasia*
- Traumatic arthritis*

Elbow

- Avulsion of the medial epicondyle
- Collateral ligament rupture or avulsion
- Degenerative joint disease*
- Elbow incongruity
- Fracture of the humerus*
- Fracture of the radius*
- Fracture of the ulna*
- Growth plate disorders
- Haemarthrosis

Luxation (congenital or acquired)

Osteochondrosis (D)*

- Fragmented medial coronoid process
- Osteochondritis dissecans of the medial condyle of the humerus
- Ununited anconeal process

Septic arthritis

Traumatic arthritis*

Carpus

Carpal hyperextension

Collateral ligament rupture or avulsion

Degenerative joint disease*

Dysostosis

Flexor tendon contracture

Fracture of the carpal bones*

Fracture of the metacarpal bones*

Fracture of the radius*

Fracture of the ulna*

Growth plate disorders

Luxation

Osteochondrosis

Septic arthritis

Shearing injury

Subluxation

Foot

Avulsion of the deep digital flexor tendon

Avulsion of the superficial digital flexor tendon

Claw disease *q.v.**

Degenerative joint disease*

Fracture of distal metacarpal bones*

Fracture of phalanges*

Injury to the integument, e.g.

- Bite wound
- Foreign body
- Laceration

Other pathology of the integument*

Luxation/subluxation

Septic arthritis

Sesamoid disease/fracture

ADULT ANIMALS

Any site

Infection*

Trauma*

- Bruising or strain of soft tissues
- Laceration
- Penetrating wound

Shoulder

Biceps tendon rupture

Bicipital tenosynovitis (D)

Degenerative joint disease*

Fracture of the humerus*

Fracture of the scapula*

Haemarthrosis

Infraspinatus contracture/other muscle contractures

Joint capsule rupture

Luxation (congenital or acquired)*

Medially displaced biceps tendon

Neoplasia*, e.g.

- Metastatic tumour
- Nerve root tumour
- Primary bone tumour
- Soft tissue tumour
- Synovial sarcoma

Osteochondrosis

Septic arthritis

Shoulder dysplasia

Traumatic arthritis*

Elbow

Collateral ligament rupture or avulsion

Degenerative joint disease*

Elbow incongruity

Fracture of the humerus*

Fracture of the radius*

Fracture of the ulna*

Haemarthrosis

Incomplete ossification of the humeral condyle

Luxation (congenital or acquired)

Medial spur

Neoplasia*

- Bone
- Metastatic
- Soft tissue

Osteochondrosis

Septic arthritis

Traumatic arthritis*

Carpus

Carpal hyperextension

Degenerative joint disease*

Fracture of the radius*

Fractures of the carpal bones*

Fractures of the metacarpal bones*

Haemarthrosis

Luxation or subluxation

Neoplasia*

- Bone
- Metastatic
- Soft tissue

Septic arthritis

Shearing injury

Traumatic arthritis*

Foot

Avulsion of the superficial or deep digital flexor tendon

Claw disease *q.v.*

Degenerative joint disease*

Fracture of the distal metacarpal bones*

Fracture of the phalanges*

Fracture of the sesamoid bones*

Haemarthrosis

Injury to the integument*, e.g.

- Bite wound
- Foreign body
- Laceration

Other pathology of the integument*

Luxation

- Neoplasia
 - Bone
 - Metastatic
 - Soft tissue
- Septic arthritis
- Sesamoid disease
- Traumatic arthritis*

1.7.2 Hindlimb lameness

YOUNG ANIMALS

Any site

- Infection
- Metaphyseal osteopathy
- Panosteitis
- Trauma
 - Bruising or strain of soft tissues
 - Laceration
 - Penetrating wound

Hip

- Avascular necrosis of the femoral head (D)
- Fracture of the acetabulum*
- Fracture of the femur*
- Haemarthrosis
- Hip dysplasia*
- Luxation*
- Septic arthritis
- Traumatic arthritis*

Stifle

- Caudal cruciate ligament rupture or avulsion
- Cranial cruciate ligament rupture or avulsion*
- Femorotibial luxation
- Fracture of the femur*
- Fracture of the fibula*
- Fracture of the patella*
- Fracture of the tibia*
- Genu valgum

Haemarthrosis
Long digital extensor tendon avulsion
Meniscal trauma*
Osteochondrosis*
Patellar ligament rupture or avulsion
Patellar luxation*
Septic arthritis
Stifle hyperextension
Traumatic arthritis*

Hock

Calcaneal tendon rupture, laceration or avulsion
Collateral ligament avulsion
Congenital tarsal anomalies
Fracture of the tibia*
Fracture of the fibula*
Fractures of the metatarsal bones*
Fractures of the tarsal bones*
Gastrocnemius tendon rupture, laceration or avulsion
Growth plate disorders
Haemarthrosis
Luxation
Osteochondrosis*
Septic arthritis
Shearing injury
Tibial dysplasia
Traumatic arthritis*

Foot

Avulsion of the superficial or deep digital flexor tendon
Claw disease *q.v.**
Degenerative joint disease*
Fractures of the distal metatarsal bones*
Fractures of the phalanges*
Fractures of the sesamoid bones
Haemarthrosis
Injury to the integument*, e.g.

- Bite wound
- Foreign body
- Laceration

Other pathology of the integument*

Luxation

Septic arthritis

Sesamoid disease

Traumatic arthritis*

ADULT ANIMALS

Any site

Infection

Trauma

- Bruising or strain of soft tissues
- Laceration
- Penetrating wound

Hip

Avascular necrosis of the femoral head*

Degenerative joint disease*

Fracture of the acetabulum*

Fracture of the femur*

Haemarthrosis

Hip dysplasia*

Luxation*

Myositis ossificans

Neoplasia*

- Bone
- Soft tissue
- Metastatic

Septic arthritis

Traumatic arthritis*

Stifle

Caudal cruciate ligament rupture or avulsion

Cranial cruciate ligament rupture or avulsion*

Degenerative joint disease*

Femorotibial luxation

Fracture of the femur*

Fracture of the fibula*

Fracture of the patella*

Fracture of the tibia*

Haemarthrosis

Long digital extensor tendon avulsion

Meniscal trauma*

Neoplasia*

- Bone

- Soft tissue

- Metastatic

Osteochondrosis*

Patellar ligament rupture or avulsion

Patellar luxation*

Septic arthritis

Stifle hyperextension

Traumatic arthritis*

Hock

Calcaneal tendon rupture, laceration or avulsion

Collateral ligament avulsion

Degenerative joint disease*

Fracture of the fibula*

Fracture of the tibia*

Fractures of the metatarsal bones*

Fractures of the tarsal bones*

Gastrocnemius tendon rupture, laceration or avulsion

Growth plate disorders

Haemarthrosis

Luxation

Neoplasia*

- Bone

- Soft tissue

- Metastatic

Osteochondrosis*

Septic arthritis

Shearing injury

Superficial digital flexor luxation

Tibial dysplasia

Traumatic arthritis*

Foot

Avulsion of the superficial or deep digital flexor tendon

Claw disease* *q.v.*

Degenerative joint disease*

Fractures of distal metatarsal bones*

Fractures of phalanges*

Fractures of sesamoid bones

Haemarthrosis

Injury to the integument*, e.g.

- Bite wound
- Foreign body
- Laceration

Other pathology of the integument*

Luxation*

Neoplasia*

- Bone
- Soft tissue
- Metastatic

Septic arthritis

Sesamoid disease

Traumatic arthritis*

Traumatic tenosynovitis

1.7.3 Multiple joint/limb lameness

Young animals

Borreliosis

Chondrodysplasia

Drug reaction

- Sulphonamide
- Vaccine

Excessive joint laxity

- Collagen defect
- Dietary
- Traumatic

Haemarthroses

Metaphyseal osteopathy (D)

Nutritional secondary hyperthyroidism

Panosteitis

Polyarthritis

Osteochondrosis*

Septic arthritis

Viral arthritis

Adult animals

Borreliosis

Chondrodysplasia

Degenerative joint disease*

Drug reaction

- Sulphonamide
- Vaccine

Excessive joint laxity

- Collagen defect
- Dietary
- Traumatic

Haemarthroses

Hyperparathyroidism

Neuromuscular disease

Osteochondrosis*

Nutritional, e.g.

- Hypervitaminosis A
- Copper deficiency

Periosteal proliferative arthritis

Polyarthritis

Septic arthritis

Systemic lupus erythematosus

Viral arthritis

1.8 Reproductive historical signs

1.8.1 Failure to observe oestrus

Abnormal sex chromosomes

Early embryonic death *q.v.*

Idiopathic

Immune-mediated oophoritis

Inadequate display of oestrus*

Inadequate observation of oestrus*

Inappropriate photoperiod (C)

Lactational anoestrus*

Panhypopituitarism

Physical/athletic training
Poor diet
Prepuberty*
Previous ovariectomy*
Pseudohermaphroditism
Pseudopregnancy*
Seasonal anoestrus (C)*
Social factors
Spontaneous ovulation
Sterile matings
True hermaphroditism

Concurrent disease

Hyperadrenocorticism
Hypoadrenocorticism (D)
Hypothyroidism* (D)
Poor body condition

Iatrogenic

Anabolic steroids
Androgens
Glucocorticoids
Progesterones

Ovarian disease

Ovarian aplasia
Ovarian cysts and tumours

- Granulosa-thecal cell tumours
- Luteal cysts
- Other neoplasms or cysts causing ovarian atrophy

Ovarian hypoplasia
Senile ovarian failure

Stress*

Frequent showing
Frequent travel
Overcrowding
Temperature extremes

1.8.2 Irregular seasons

Short pro-oestrus followed by anoestrus

Poor diet

Shortened inter-pro-oestrus intervals (see succeeding text)

Stress

Reduced intensity of visible signs of oestrus

Concurrent disease*

Drugs*

- Anabolic steroids
- Androgens
- Glucocorticoids
- Progesterones

Persistence of oestrus behaviour

Signs of oestrus in the absence of true hormonal oestrus

Vaginal foreign body

Vaginal tumour

Vaginitis*

Vulvitis*

Prolonged pro-oestrus/oestrus

Excessive adrenal production of oestrogen (C)

Follicular cysts*

Hepatic disease

Merging of waves of follicular growth (C)

Normal in young females*

Iatrogenic

Drugs used to prevent pregnancy after mating

Exogenous gonadotrophins

Ovarian tumours

Adenocarcinoma

Cystadenoma

Granulosa cell tumour

Shortened inter-pro-oestrus interval

- Follicular cysts
- Frequent episodes of pro-oestrus
- Ovulatory failure
- Short anoestrus
- Split heats

Iatrogenic

- Bromocriptine
- Cabergoline
- Prostaglandins

Prolonged inter-pro-oestrus interval

- Normal in some breeds
- Hypothyroidism* (D)
- Idiopathic
- Ovarian cysts or neoplasia
- Severe systemic disease
- Silent heat

1.8.3 Infertility in the female with normal oestrus**Failure to achieve intromission**

Male factors* *q.v.*

Congenital defects of the vestibule and vagina

- Intersexes
- Vaginal septa
- Vestibulovaginal strictures
- Vulval constrictions

Acquired vaginal conditions

- Foreign body
- Post-partum fibrosis
- Transmissible venereal tumour
- Vaginal hyperplasia*

Vaginal tumours
Vaginal ulceration

Failure of ovulation

Idiopathic (D)
Inadequate number of matings (C)
Incorrect timing of mating* (C)

Miscellaneous

Cervical stenosis
Cystic endometrial hyperplasia*
Early embryonic loss *q.v.*
Endometritis
Herpesvirus
Hypoluteodism/insufficient progesterone secretion by corpus luteum
Incorrect timing of mating/insemination*
Infertile male
Non-patent oviducts or uterus
Segmental aplasia of the paramesonephric (Müllerian) duct
Stress
Uterine polyps
Uterine tumours

1.8.4 Male infertility

Failure to achieve intromission

Female factors *q.v.*

Acquired abnormalities

Neoplasia of the penis/prepucce
Phimosis
Trauma of the penis/prepucce
Urethral obstruction and subsequent haematoma

Congenital abnormalities, e.g.

Diphallus
Penile hypoplasia
Persistent penile frenulum
Preputial stenosis
Pseudohermaphroditism

Miscellaneous

Incomplete erection

Ineffective thrusting

- Experience*
- Poor socialisation*
- Short os penis
- Size discrepancy*
- Trauma (desensitised glans)

Premature full attainment of erection in inexperienced dog*

Premature loss of erection*

Inability to mount the female

Prostatic disease *q.v.*

Orthopaedic disease*

Lack of fertility where normal mating(s) is(are) achieved*Failure of/incomplete ejaculation*

Discomfort or stress during mating*

Inadequate tie*

Retrograde ejaculation

- Disorder of the sympathetic nervous system
- Urethral sphincter incompetence

Lack of libido*Age related*

Prepubertal*

Senility*

Behavioural

Inexperience*

Previous bad experience when mating*

Training not to display sexual interest*

Concurrent/systemic disease, e.g.*

Hypoadrenocorticism

Hypogonadism

Hypothyroidism* (D)

Diet

Malnutrition

Obesity*

Drugs

Anabolic steroids
Cimetidine
Glucocorticoids
Ketoconazole
Oestrogens
Overuse of testosterone
Progestagens

Management

Overuse*

Testicular disease

Idiopathic testicular degeneration
Orchitis
Sertoli cell tumour

Low/absent sperm number or quality***Artefact***

Poor collection technique/analysis*

Acquired defects

Infections causing azoospermia or abnormal sperm/semen

- Balanoposthitis
- Epididymitis
- Orchitis
- Prostatitis
- Urethritis

Increases in testicular temperature

- Chemotherapeutics, e.g.
 - Chlorambucil
 - Cisplatin
 - Cyclophosphamide
- High environmental temperature
- Hyperthermia
- Iatrogenic
- Orchitis in the contralateral testis
- Other drugs
 - Anabolic steroids
 - Androgens
 - Glucocorticoids

- Radiation therapy/excessive radiography
- Scrotal dermatitis

Local trauma

- Dog bites
- Kicks/blows
- Lacerations

Neoplasia of the testis

Overuse*

Pain*

Prepuberty*

Retrograde ejaculation

Toxins

Congenital defects

Cryptorchidism

Genetic abnormalities in spermatogenesis

- Chromosomal abnormalities, e.g.
 - XXY syndrome (D)
 - 38,XY/57,XXY (C)
- Immotile cilia (Kartagener's syndrome)

Segmental aplasia of the duct system

Testicular hypoplasia

1.8.5 Vaginal/vulval discharge

Ovarian remnant syndrome

Pseudopregnancy*

Pyometra*

Stump pyometra*

Vaginal or uterine neoplasia

Vaginitis*

Vulvitis*

1.8.6 Abortion

Drugs, e.g.

Cabergoline

Corticosteroids

Prostaglandins

Habitual abortion

Abnormal uterine environment, e.g.

- Cystic endometrial hyperplasia
- Poor luteal function

Infection

Brucella canis (D)

Canine adenovirus (D)

Canine distemper virus (D)*

Canine herpesvirus (D)

Chlamydophila psittaci (C)

Ehrlichiosis

Feline herpesvirus (C)*

Feline infectious peritonitis (C)*

Feline leukaemia virus (C)*

Feline panleukopenia virus (C)*

Leishmaniasis

Toxoplasmosis

1.8.7 Dystocia

MATERNAL CAUSES

Obstruction of the birth canal

Congenital uterine malformations

- Aplasia of the cervix
- Aplasia of the corpus uteri
- Aplasia of the uterine horns

Fibrosis of the birth canal

Narrow pelvic canal

- Congenital
- Fracture*
- Immaturity*

Neoplasia

Uterine malposition

Uterine rupture

Uterine torsion
Vaginal septa

Uterine inertia*

Primary uterine inertia

Fatty infiltration of the myometrium
Hormonal deficiencies
Hypocalcaemia* *q.v.*
Inherited
Maternal systemic disease
Overstretching of the myometrium, e.g.

- Excessive intrauterine fluids
- Large foetuses*
- Large litter*

Poor diet
Senile changes*
Single puppy syndrome*

Secondary uterine inertia

Exhaustion of the myometrium*

- Obstruction of birth canal*
- Prolonged labour*

FOETAL CAUSES

Malpresentation*

Backward flexion of front legs
Breech
Lateral or downward deviation of the head
Posterior
Transverse
Two foetuses presenting simultaneously

Oversized foetuses

Physically normal but large puppy*
Monstrosities

- Duplications
- Hydrocephalus
- Oedema

1.8.8 Neonatal mortality

Congenital abnormalities*, e.g.

Congenital heart disease
Hydrocephalus
Hypothyroidism

Infections*, e.g.

Feline calicivirus*
Feline herpesvirus*
Feline infectious peritonitis*
Feline parvovirus*
Septicaemia

Maternal/management factors*

Asphyxiation
Euthanasia for reasons of congenital deformities or undesirable cosmetic features
Hypoglycaemia *q.v.*, e.g.

- Secondary to sepsis

Hypothermia
Inadequate lactation
Poor environment, e.g.

- Draughts
- Heating

Poor hygiene
Poor mothering
Poor nutrition/health of breeding stock

Miscellaneous

Fading puppy syndrome*
Low birth weight
Neonatal isoerythrolysis
Stillbirth

1.9 Urological historical signs

1.9.1 Pollakiuria/dysuria/stranguria

Normal urine

Behavioural*
Feline lower urinary tract disease
Idiopathic detrusor-urethral dyssynergia
Neuromuscular

With haematuria, pyuria or bacteriuria

Diabetes mellitus*
Feline lower urinary tract disease* (C)
Hyperadrenocorticism/corticosteroid treatment
Iatrogenic disorders
Infection
Infiltrative urethral diseases
Neoplasia
Neuromuscular disorders
Prostatic disease
Renal disease* *q.v.*
Structural abnormalities
Trauma/bladder rupture
Urolithiasis*

1.9.2 Polyuria/polydipsia (see Section 1.1.1 for full differentials)

Diet
Drugs/toxins
Congenital lack of ADH receptors
Electrolyte disorders
Endocrine disease
Hepatobiliary disease
Hypothalamic disease
Infectious disease

Metabolic (e.g. hypercalcaemia)
Neoplasia*
Pericardial effusion
Physiological
Polycythaemia
Psychogenic
Renal disorders

1.9.3 Anuria/oliguria

Pre-renal

Dehydration*
Hypoadrenocorticism (D)
Shock *q.v.**

Renal

Acute kidney injury *q.v.*
Chronic kidney disease*

Post-renal

Prostatic disease*
Urethral spasm

Neoplasia

Bladder
Extra-urinary tract
Urethra

Trauma

Avulsion of ureters
Ruptured bladder/urethra

*Urolithiasis**

Nephroliths
Ureteroliths
Uroliths in the bladder or urethra

1.9.4 Haematuria

Extra-urogenital disease

Coagulopathy *q.v.*

Drugs/toxins

- Paracetamol

Heatstroke

Thrombocytopenia/thrombocytopathia

Penile disease

Neoplasia

Trauma

Physiological

Pro-oestrus

Prostatic disease

Abscess

Benign prostatic hyperplasia* (D)

Cysts

Neoplasia

Prostatitis*

Pseudohaematuria (non-haematuria-related red urine)

Bilirubinuria *q.v.*

Food pigments

- Blackberries
- Beets
- Rhubarb

Haemoglobinuria *q.v.*

Myoglobinuria *q.v.*

Phenazopyridine

Phenolphthalein

Phenothiazines

Renal disease

Cysts

Glomerulonephritis

Iatrogenic

- Biopsy
- Fine-needle aspirate

Idiopathic renal haematuria

Infarction, e.g.

- Disseminated intravascular coagulation

Neoplasia*

Parasites

- *Dioctophyma renale*

Pyelonephritis

Renal telangiectasia

Trauma

Uroliths*

Ureteral, urinary bladder and urethral disease

Drugs

- Cyclophosphamide

Feline lower urinary tract disease*

Iatrogenic

- Cystocentesis*
- Forceful catheterisation*

Neoplasia

Parasites

- *Capillaria plica*

Polyps

Trauma*

Urethritis

Uroliths*

Uterine disease

Metritis

Neoplasia

Pyometra*

Sub-involution*

Vaginal disease

Neoplasia

Trauma

1.9.5 Urinary incontinence/inappropriate urination

With bladder distension

Detrusor atony

Bladder over-distension

Dysautonomia

Lower motor neurone disease

Neoplastic infiltration of the bladder wall

Upper motor neurone disease

Functional obstruction

Reflex dyssynergia*

Upper motor neurone disease

Urethral inflammation*

Urethral pain

Partial physical obstruction

Granulomatous urethritis

Neoplasia

Prostatic disease*

Retroflexion of the bladder into a perineal hernia

Urethral fibrosis/stricture

Urolithiasis*

Vestibulovaginal stenosis

Without bladder distension

Bladder hypercontractility

Chronic partial obstruction*

Detrusor instability

Inflammation*

Neoplasia

Miscellaneous

Behavioural

Ectopic ureters

Iatrogenic

- Urerterovaginal fistulation

Secondary to polydipsia/polyuria

Ureterocele

Urolithiasis

Reduced bladder storage

Fibrosis

Hypoplasia

Neoplasia

Urethral sphincter incompetence

Congenital

Hormone responsive*

Intersex

Prostatic disease*

Urethral inflammation*

Urethral neoplasia

Urinary tract infection*

PART 2

PHYSICAL SIGNS

2.1 General/miscellaneous physical signs

2.1.1 Abnormalities of body temperature – hyperthermia

TRUE FEVER

Drugs/toxins

Adder bites
Amphotericin B
Aspirin
Benzalkonium chloride
Benzodiazepines
Borax
Cannabis
Carbamate
Daffodil
Dichlorophen
Diclofenac sodium
Dinoprost tromethamine
Glyphosate
Horse chestnut
Hymenoptera stings
Indomethacin
Ivermectin

Metaldehyde
Organophosphates
Oxytetracycline
Paracetamol
Paraquat
Penicillamine
Petroleum distillates
Phenytoin
Poinsettia
Procainamide
Pyrethrin/pyrethroids
Salbutamol
Theobromine
Yew

Immune-mediated disease

Autoimmune skin disease

- Bullous pemphigoid
- Discoid lupus erythematosus
- Pemphigus erythematosus
- Pemphigus foliaceus
- Pemphigus vulgaris

Drug reactions

Evan syndrome

Familial renal amyloidosis (Shar Pei fever)

Immune-mediated haemolytic anaemia*

Immune-mediated joint disease*

- Erosive
 - Rheumatoid arthritis
- Non-erosive
 - Chronic inflammatory/infectious
 - Idiopathic
 - Enteropathic
 - Neoplasia
 - Periosteal proliferative arthritis
 - Systemic lupus erythematosus

Immune-mediated thrombocytopenia

Lymphadenitis

Pemphigus

Plasmacytic-lymphocytic gonitis

Polyarteritis nodosa
Polymyositis
Steroid-responsive meningitis
Systemic lupus erythematosus

Immunodeficiency syndromes

Defects in specific immunity, e.g.

Agammaglobulinaemia
C3 deficiency
Canine leucocyte adhesion deficiency
Lethal acrodermatitis
Low immunoglobulins in Weimaraners (D)
Neutrophil defect of Weimaraners (D)
Pneumocystic pneumonia in miniature
Dachshunds (D)
Transient hypogammaglobulinaemia
Selective immunoglobulin (IgA) deficiency
Selective IgM deficiency
Severe combined immunodeficiency disease

Defects in non-specific immunity

Bone marrow dyscrasia in Poodles (D)
Canine cyclic haematopoiesis (D)
Canine granulocytopathy syndrome (D)
Chediak–Higashi syndrome (C)
Complement deficiency (D)
Hypotrichosis with thymic aplasia (C)
Immotile cilia syndrome
Trapped neutrophil syndrome
Pelger–Huet anomaly

Secondary immunodeficiencies

Drugs

- Corticosteroids
- Immunosuppressive therapy

Endocrine

- Hyperadrenocorticism

Infectious, e.g.

- Canine distemper virus* (D)
- Demodexosis*

- Feline immunodeficiency syndrome* (C)
- Feline leukaemia virus* (C)
- Parvovirus

Metabolic

- Uraemia

Neoplastic

- Haematopoietic

Nutritional

- Zinc deficiency

Infection

Bacterial

Generalised/multifocal, e.g.

- Bartonellosis
- Brucellosis (D)
- Leptospirosis*
- Lyme disease
- *Mycobacterium* spp.
- *Mycoplasma* spp.
- Plague
- Septicaemia from septic focus

Localised, e.g.

- Abscess*, e.g.
 - Dental
 - Lung
 - Retrobulbar
- Cellulitis*
- Cholangiohepatitis
- Cystitis
- Dental disease*
- Discospondylitis
- Endocarditis
- Gastrointestinal infection*
- Mastitis
- Metritis*
- Osteomyelitis*
- Peritonitis*
- Pneumonia*
- Prostatitis*

- Pyelonephritis
- Pyometra/stump pyometra*
- Pyothorax*
- Septic arthritis*
- Urinary tract infection*

Fungal, e.g.

Aspergillosis
Blastomycosis
Coccidioidomycosis
Cryptococcosis
Histoplasmosis

Parasitic, e.g.

Aberrant helminth migration
Babesiosis
Chagas disease (Trypanosomiasis)
Cytauxzoon felis
Dirofilaria immitis
Hepatozoonosis
Leishmaniasis

Protozoal, e.g.

Neosporosis (D)
Toxoplasmosis

Rickettsial, e.g.

Ehrlichiosis
Rocky Mountain spotted fever (D)
Salmon poisoning

Viral (many), e.g.

Canine distemper virus* (D)
Canine hepatitis virus* (D)
Canine parainfluenza virus* (D)
Canine parvovirus* (D)
Feline calicivirus* (C)
Feline herpes virus* (C)
Feline immunodeficiency virus* (C)
Feline infectious peritonitis* (C)
Feline leukaemia virus* (C)
Feline panleukopenia virus* (C)

Miscellaneous

Metabolic bone disorders

- Hypervitaminosis A (C)
- Metaphyseal osteopathy
- Nutritional secondary hyperthyroidism
- Panosteitis

Pansteatitis (C)

Portosystemic shunt

True pyrexia of unknown origin

Neoplasia

Lymphoma*

Lymphoproliferative disease

Leukaemia

Histiocytic disease (systemic histiocytosis, malignant histiocytosis, histiocytic sarcoma)

Myeloproliferative disease

Solid tumours*

Tissue damage*

Surgery*

Trauma*

OTHER CAUSES OF HYPERTHERMIA

Heat stroke*

Hyperpyrexic syndrome

Increased muscular activity

Episodic myokymia

Hypocalcaemic tetany *q.v.*

Normal exercise*

Pain

Seizures* *q.v.*

Stress

Pathological hyperthermia

Hypermetabolic states

- Hyperthyroidism* (C)
- Pheochromocytoma

Hypothalamic lesions

Malignant hyperthermia

2.1.2 Abnormalities of body temperature – hypothermia

Drugs/toxins

Alphachloralose
Baclofen
Benzodiazepines
Cannabis
Daffodil
Ethylene glycol
General anaesthetics
Ivermectin
Loperamide
Paracetamol
Sedatives
Yew

Miscellaneous

Aortic thromboembolism* (C)
Cardiac disease* *q.v.*
Coma *q.v.*
Environmental cold*
Hypoadrenocorticism (D)
Hypothalamic disorders
Hypothyroidism* (D)
Loss of thermoregulatory abilities following heat stroke
Near drowning
Severe sepsis/endotoxaemia*

2.1.3 Enlarged lymph nodes

INFILTRATION

Neoplastic disease

Haemolymphatic

Leukaemia
Lymphoma*
Lymphomatoid granulomatosis

Malignant histiocytosis
Multiple myeloma
Systemic mastocytosis

Metastatic

Adenocarcinoma
Carcinoma
Malignant melanoma
Mast cell tumour
Sarcoma

Non-neoplastic disease

Eosinophilic granuloma complex
Mast cell infiltration

PROLIFERATION/INFLAMMATION

Infectious

Algal

Protothecosis

Bacterial

Actinomycosis
Bartonella spp.
Brucella canis (D)
Corynebacterium spp.
Localised infection
Mycobacterium spp.
Nocardiosis
Septicaemia
Streptococcus spp.
Yersinia pestis

Fungal

Aspergillosis
Blastomycosis
Coccidioidomycosis
Cryptococcosis
Histoplasmosis

Phycomycosis
Sporotrichosis

Parasitic

Babesiosis
Cyttauxzoonosis
Demodecosis
Hepatozoonosis
Leishmaniasis
Trypanosomiasis

Protozoal

Neosporosis (D)
Toxoplasmosis

Rickettsial

Ehrlichiosis
Rocky Mountain spotted fever
Salmon poisoning

Viral

Canine herpes virus* (D)
Feline immunodeficiency virus* (C)
Feline infectious peritonitis* (C)
Feline leukaemia virus* (C)
Infectious canine hepatitis* (D)

Non-infectious

Dermatopathic lymphadenopathy

Drug reactions

Idiopathic

Immune-mediated

- Immune-mediated polyarthritides
- Mineral-associated lymphadenopathy
- Granulomatous lymphadenitis
- Puppy strangles* (D)
- Rheumatoid arthritis
- Systemic lupus erythematosus

Localised inflammation*

Post-vaccine

2.1.4 Diffuse pain

Gastrointestinal disease, e.g.

- Cholecystolithiasis/cholecystitis*
- Gastrointestinal inflammation/ulceration
- Gastrointestinal parasitism*
- Pancreatitis*

Miscellaneous

- Panniculitis

MUSCULOSKELETAL DISEASE, E.G.

- Polyarthritis
- Polymyositis

Neurological disease, e.g.

- Meningoencephalitis
- Spinal disease* *q.v.*
- Thalamic pain syndrome

Urological disease, e.g.

- Cystitis
- Prostatic disease*
- Pyelonephritis
- Renal parasitism
- Urethral tumour
- Urolithiasis

Other causes of abdominal pain *q.v.*

- Mesenteric thrombosis
- Pansteatitis
- Peritonitis

2.1.5 Peripheral oedema

Generalised

- Hypoalbuminaemia* *q.v.*
- Increased central venous pressure

- Central venous occlusion
 - Neoplasia
 - Thrombosis
- Congestive heart failure*

Vasculitis

Localised

Arteriovenous fistula

Cellulitis*

Drugs/toxins

- Alphaxalone/alphadolone
- Paracetamol
- Salbutamol

Inflammation*

Lymphangitis

Lymphoedema

Neurogenic or hormonal vasoactive stimuli

Proximal venous obstruction

Vascular trauma

Vasculitis

Regional

Bilateral forelimb oedema/head and neck oedema

Cranial vena cava syndrome

- Compression of cranial vena cava,
e.g. by mediastinal mass
- Granuloma of cranial vena cava
- Neoplasia of cranial vena cava
- Thrombosis of cranial vena cava

Bilateral hind limb oedema

Budd–Chiari-like syndrome

Obstruction of sublumbar lymph nodes,
e.g. neoplasia

Increased central venous pressure

Central lymph obstruction

Central venous occlusion, e.g.

- Mediastinal mass
- Thrombosis

2.1.6 Hypertension

Adrenal disease

Hyperadrenocorticism
Hyperaldosteronism
Pheochromocytoma

Anaemia* q.v.

CNS disease q.v.

Drugs/toxins

Corticosteroids
Ciclosporin A
Dobutamine
Dopamine
Doxapram
Erythropoietin
Fludrocortisone
Phenylpropanolamine
Theobromine

Endocrine disease

Acromegaly
Diabetes mellitus* (D)
Hyperoestrogenism
Hyperthyroidism* (C)

Hyperviscosity

Hyperglobulinaemia q.v.
Polycythaemia q.v.

Iatrogenic

Overzealous fluid administration

Idiopathic

Essential/primary hypertension

Renal disease

Renal arterial disease

Renal parenchymal disease

- Amyloidosis
- Chronic interstitial nephritis*
- Glomerulonephritis
- Glomerulosclerosis
- Pyelonephritis

Thyroid disease

Hyperthyroidism* (C)

2.1.7 Hypotension

Decreased cardiac function

Arrhythmias* *q.v.*
Cardiomyopathy*
Congenital heart disease
Electrolyte/acid–base disorders* *q.v.*
Hypoxia
Valvular disease*

Decreased preload

Heatstroke*
Hypoadrenocorticism (D)
Hypovolaemia*

- Blood donation
- Burns
- Effusions *q.v.*
- Diarrhoea *q.v.*
- Haemorrhage *q.v.*
- Polyuria without polydipsia *q.v.*
- Vomiting *q.v.*

Decreased vascular tone

Anaphylaxis
Babesiosis
Electrolyte/acid–base disorders* *q.v.*
Hypoxia
Neurological disease *q.v.*
Systemic inflammatory response syndrome

Decreased venous return

Cardiac tamponade
Caval syndrome/heartworm disease
Gastric dilatation/volvulus*
Pneumothorax* *q.v.*
Positive pressure ventilation
Restrictive pericarditis

Drugs/toxins

ACE inhibitors
Adder bites
Amiloride
Amiodarone
Daffodil
Diazoxide
Dopamine
General anaesthetics and sedatives
Hydralazine
Hymenoptera stings
Indomethacin
Isosorbide dinitrate
Lignocaine
Medetomidine
Mexiletine
Midazolam
Mistletoe
Nitroprusside
Oxytetracycline (intravenous)
Phenoxybenzamine
Prazosin
Procainamide
Propofol
Pyridostigmine
Quinidine
Ranitidine (intravenous)
Rhododendron
Snake venom
Sotalol
Terbutaline
Terfenadine

Tricyclic antidepressants
Verapamil
Xylazine
Yew

2.2 Gastrointestinal/abdominal physical signs

2.2.1 Oral lesions

Congenital deformities e.g.

Cleft palate

Neoplasia

Oropharyngeal tumours

Extramedullary plasmacytoma
Fibroma/fibrosarcoma
Fibropapilloma
Granular cell tumour
Haemangiosarcoma
Histiocytoma
Lymphoma
Mast cell tumour
Melanoma*
Mixed mesenchymal sarcoma
Papilloma (D)
Rhabdomyosarcoma
Squamous cell carcinoma
Transmissible venereal tumour (D)

Odontogenic tumours

Acanthomatous epulides
Ameloblastic adenomatoid
Ameloblastoma
Calcifying epithelial odontogenic tumour
Cementoma
Dentinoma

Fibromatous epulides
Fibromyxoma
Hamartoma
Inductive fibroameloblastoma (C)
Keratinising ameloblastoma (C)
Odontogenic fibroma
Odontoma
Ossifying epulides

Inflammatory masses, e.g.

Feline eosinophilic granuloma complex*

Oral ulceration

Immune-mediated/inflammatory, e.g.
• Eosinophilic granuloma complex*
• Lymphoplasmacytic*

Infectious, e.g.

- Feline calicivirus

Ingestion of irritant/caustic substances*

Metabolic, e.g.

- Uraemia* *q.v.*

Traumatic*

Periodontitis/gingivitis

Bacterial infection*

Diabetes mellitus*

Diet (non-abrasive)*

Immune deficiency, e.g.

- Feline immunodeficiency virus* (C)
- Feline leukaemia virus* (C)

Immune-mediated disease, e.g.

- Lymphoplasmacytic*

Periodontal foreign material*, e.g.

- Grass
- Hair

Tooth abnormalities*, e.g.

- Crowding
- Malocclusion
- Rough surfaces

Salivary gland enlargement

Infarction

Infection

Neoplasia

- Acinic cell tumour
- Adenocarcinoma
- Monomorphic adenoma
- Mucoepidermoid tumour
- Pleomorphic adenoma
- Undifferentiated carcinoma

Sialadenitis

Sialadenosis

Sialocele

Stomatitis

Immune-mediated/inflammatory, e.g.

- Eosinophilic stomatitis
- Lymphoplasmacytic stomatitis*

Infection, e.g.

- *Bartonella henselae*
- Feline calicivirus* (C)
- Feline herpes virus* (C)

Ingestion of irritant/caustic substances

Metabolic, e.g. uraemia*

Traumatic*

Tooth disease

Caries

Feline odontoclastic resorptive lesions* (C)

Trauma*

2.2.2 Abdominal distension

Abdominal neoplasia*

Ascites* *q.v.*

Bladder distension* *q.v.*

Gastric dilatation*

Gastric distension*

Intestinal dilatation/volvulus

Obesity

Obstipation* *q.v.*

Organomegaly*

- Enlarged kidney *q.v.*
- Enlarged uterus *q.v.*
- Hepatomegaly *q.v.*
- Splenomegaly *q.v.*

Pneumoperitoneum

Pregnancy

Weakness of abdominal musculature

- Hyperadrenocorticism
- Ruptured prepubic tendon

2.2.3 Abdominal pain

Drugs/toxins

Allopurinol

Blue-green algae

Borax

Daffodil

Diclofenac sodium

Dieffenbachia

Horse chestnut

Ibuprofen

Indomethacin

Itraconazole

Loperamide

Metaldehyde

Misoprostol

Naproxen

NPK fertilisers

Paracetamol

Paraquat

Petroleum distillates

Phenoxy acid herbicides

Poinsettia

Rhododendron

Theobromine

Zinc sulphate

Gastrointestinal disease

Colitis*
Constipation* *q.v.*
Enteritis*
Gastric dilatation/volvulus* (D)
Gastric foreign body*
Gastric ulceration*
Gastritis*
Intestinal volvulus
Neoplasia*
Small intestinal foreign body*

Hepatobiliary disease

Cholangitis
Cholecystitis*
Cholelithiasis
Gall bladder obstruction
Hepatitis*
Liver lobe torsion
Portal hypertension

Mechanical factors

Dilatation of a hollow viscus
Bladder distension* *q.v.*
Gastric dilatation/volvulus* (D)
Intestinal dilatation, e.g.

- Foreign body
- Volvulus

Obstruction of outflow
Obstruction of bile outflow
Urinary tract obstruction

Mesenteric tension/traction/torsion

Abscess
Bowel incarceration in hernia or mesenteric tear
Cryptorchid testicular torsion
Foreign body*
Haematoma
Intestinal volvulus

Gastric dilatation/volvulus* (D)
Intussusception*
Neoplasia
Splenic torsion
Stenosis/stricture
Uterine torsion

Miscellaneous

Mesenteric thromboembolism
Sterile nodular panniculitis and pansteatitis
in Weimaraners

Musculoskeletal pain

Abdominal muscle rupture
Referred spinal pain*

Organ rupture

Bile duct
Gall bladder
Intestine
Spleen
Stomach
Urinary tract
Uterus, e.g.
• Pyometra

Pancreas

Pancreatic abscess
Pancreatitis*
Pancreatic neoplasia

Peritoneal cavity

Ascites *q.v.*
Pneumoperitoneum

Haemoabdomen

Angiostrongylus vasorum infection
Coagulopathy *q.v.*
Neoplasia*
Trauma*

Peritonitis

- Blunt trauma*
- Feline infectious peritonitis* (C)
- Iatrogenic, e.g.
 - Post-surgical*
- Pancreatitis*
- Penetrating trauma
- Primary (C)
- Prostatitis*
- Rupture or penetration of gastrointestinal tract
- Ruptured pyometra

Uroabdomen

- Rupture of urinary tract

Reproductive system

- Labour/dystocia*
- Metritis*
- Prostatic disease
- Pyometra*

Trauma

- Fractures*
- Ruptured viscus

Urinary system

- Cystitis*
- Lower urinary tract obstruction*
- Nephritis
- Nephrolithiasis
- Pyelonephritis
- Ureteral obstruction

2.2.4 Perianal swelling

*Anal/rectal prolapse**
*Faecal tenesmus**

Anal sac disease

- Anal sac abscess*
- Anal sac adenocarcinoma

Anal sac impaction*

Anal sacculitis*

Neoplasia

Perianal adenoma*

Other perianal neoplasia

*Perineal hernia**

Idiopathic

Secondary to causes of tenesmus *q.v.*

2.2.5 Jaundice

PRE-HEPATIC

Haemolytic anaemia *q.v.*

Congenital porphyria

Ineffective erythropoiesis

Internal haemorrhage

Severe myolysis

HEPATIC

Drugs/toxins

Barbiturates

Blue-green algae

Carbamazole

Diazepam

Glipizide

Glucocorticoids

Glyphosate

Griseofulvin

Ketoconazole

Methimazole

Methyltestosterone

Metronidazole

Mexiletine

NSAIDS, e.g.

- Carprofen

- Ibuprofen
- Paracetamol
- Phenylbutazone

Phenobarbitone

Plastic explosives

Primidone

Salicylates

Sulphasalazine

Tetracycline

Intrahepatic cholestasis

Hepatic necrosis, e.g.

Infection

Toxin

Infection

Bacterial*

Fungal

Viral

- Adenovirus* (D)
- Feline immunodeficiency virus* (C)
- Feline infectious peritonitis* (C)
- Feline leukaemia virus* (C)

Inflammation

Cholangitis/cholangiohepatitis*

Miscellaneous

Amyloidosis

Cirrhosis

Hepatic erythrohaemophagia syndrome

Hepatic lipidosis

Polycystic kidney disease with
liver cysts (C)

Neoplasia, e.g.

Lymphoma*

Mast cell tumour

Myeloproliferative disease

POST-HEPATIC

Bile duct occlusion

Extraluminal

- Choledochal cysts (C)
- Duodenal disease
- Pancreatic neoplasia
- Pancreatitis*
- Polycystic disease (C)
- Secondary to peribiliary disease
- Stricture at *porta hepatis*

Intramural

- Cholangitis
- Cholecystitis*
- Choledochitis
- Gall bladder/duct neoplasia

Intraluminal

- Choledochal cysts (C)
- Cholelithiasis
- Gall bladder mucocoele
- Haemobilia
- Insipidated bile
- Polycystic kidney disease with liver cysts(C)

2.2.6 Abnormal liver palpation

Generalised enlargement

Drugs

- Glucocorticoids

Endocrine disease

- Diabetes mellitus*
- Hyperadrenocorticism

Inflammation/infection, e.g.

- Abscess*
- Cholangiohepatitis*
- Feline infectious peritonitis* (C)

Fungal infection
Granuloma
Hepatitis*
Lymphocytic cholangitis

Miscellaneous

Amyloidosis
Cholestasis (see Jaundice *q.v.*)
Cirrhosis (early)
Hepatic lipidosis
Nodular hyperplasia
Peliosis
Storage diseases

Neoplasia e.g.*

Lymphoma
Malignant histiocytosis

Venous congestion

Caudal vena cava occlusion (post-caval syndrome)

- Adhesions
- Cardiac neoplasia
- Congenital cardiac disease
- Diaphragmatic rupture/hernia*
- Dirofilariasis
- Pericardial disease
- Thoracic mass*
- Thrombosis
- Trauma

Right-sided congestive heart failure, e.g.

- Dilated cardiomyopathy*
- Pericardial effusion

Focal enlargement

Abscess*
Biliary pseudocyst
Cyst
Granuloma
Haematoma*
Hepatic arteriovenous fistula
Hyperplastic/regenerative nodule*
Liver lobe torsion

Neoplasia

Adenocarcinoma*
Biliary cystadenoma
Haemangiosarcoma*
Hepatocellular carcinoma*
Hepatoma
Lymphoma*
Malignant histiocytosis
Metastatic*

Reduced liver size

Cirrhosis*
Diaphragmatic rupture/hernia* (apparent reduction)
Hypoadrenocorticism (D)
Idiopathic hepatic fibrosis
Portosystemic shunt

- Acquired
- Congenital

2.3 Cardiorespiratory physical signs

2.3.1 Dyspnoea/tachypnoea

Drugs/toxins

Benzalkonium chloride
Blue-green algae
Dichlorophen
Ibuprofen
Metaldehyde
Naproxen
Paracetamol (methaemoglobinaemia)
Paraquat
Salbutamol
Strychnine
Terfenadine

Physiological causes

Exercise
Fear

High ambient temperature
Pain

Upper airway disorders

Cervical tracheal disease

Extraluminal compression
Foreign body
Hypoplasia/stenosis
Neoplasia

- Extraluminal
- Intraluminal
 - Adenocarcinoma
 - Chondroma
 - Chondrosarcoma
 - Leiomyoma
 - Lymphoma
 - Osteochondroma
 - Osteosarcoma
 - Plasmacytoma
 - Polyps
 - Rhabdomyosarcoma
 - Squamous cell carcinoma

Tracheal collapse*

Trauma

Laryngeal disease

Everted saccules* (D)
Inflammation
Laryngeal paralysis* (D)
Neoplasia
Oedema*

Nasal disease (more often dyspnoea than tachypnoea) e.g.

Aspergillosis
Foreign body*
Inflammatory disease*
Nasopharyngeal polyp
Neoplasia
Stenotic nares

Pharyngeal disease

Elongated or oedematous soft palate* (D)
Enlarged tonsils*

Lower airway disorders*Thoracic tracheal disease, e.g.*

Extraluminal compression
Foreign body
Hypoplasia/stenosis
Neoplasia (extra- or intraluminal)
Tracheal collapse*
Trauma

Bronchial disease

Bronchiectasis
Broncho-oesophageal fistula
Bronchitis* (D)
Cystic-bullous lung disease, e.g. secondary to emphysema
Eosinophilic bronchitis*
Extraluminal compression

- Enlarged left atrium
- Hilar lymphadenopathy, e.g.
 - Fungal disease
 - Granulomatous disease
 - Neoplasia

Feline asthma* (C)

Foreign body

Lungworm

Neoplasia

Primary ciliary dyskinesia

Pulmonary parenchymal disease

Foreign body
Abscess
Chronic pulmonary fibrosis
Eosinophilic bronchopneumonopathy
Eosinophilic pneumonitis
Eosinophilic pulmonary granulomatosis
Hilar lymph node enlargement
Inhalation pneumonia
Idiopathic pulmonary fibrosis

Inflammatory disease

Irritating gases

Near drowning

Neoplasia*

Paraquat toxicity

Pneumonia/infectious disease*

- Aspiration/inhalation pneumonia
- Bacterial, e.g.
 - *Bordetella bronchiseptica*
 - *Chlamydophila psittaci*
 - *Escherichia coli*
 - *Klebsiella pneumoniae*
 - *Mycobacterium* spp.
 - *Mycoplasma pneumoniae*
 - Pasteurellosis
- Endogenous lipid pneumonia
- Fungal, e.g.
 - Aspergillosis
 - Blastomycosis
 - Coccidioidomycosis
 - Cryptococcosis
 - Histoplasmosis
 - Pneumocystis
- Parasitic, e.g.
 - *Aelurostrongylus abstrusus*
 - *Angiostrongylus vasorum*
 - *Capillaria aerophila*
 - *Crenosoma vulpis*
 - *Oslerus* spp.
 - *Paragonimus kellicotti*
 - Visceral larval migrans
- Protozoal, e.g.
 - Toxoplasmosis
- Rickettsial
- Viral, e.g.
 - Canine distemper virus* (D)
 - Feline calicivirus* (C)
 - Feline immunodeficiency virus* (C)
 - Feline leukaemia virus* (C)

Pulmonary oedema *q.v.*

Pulmonary thromboembolism, e.g.

- Cardiac disease
- Heartworm disease
- Hyperadrenocorticism

Smoke inhalation

Trauma, e.g.

- Pulmonary contusions
- Pulmonary haemorrhage

Restrictive disorders

Diaphragmatic hernia, e.g.

- Peritoneopericardial diaphragmatic hernia
- Traumatic*

Large intra-abdominal mass

Neoplasia

- Mediastinal
- Thoracic wall

Pickwickian syndrome (extreme obesity)

Pleural effusion* *q.v.*

Pneumothorax* *q.v.*

Severe ascites *q.v.*

Severe gastric distension

Severe hepatomegaly *q.v.*

Thoracic wall abnormalities, e.g.

- Neoplasia
- Pectus excavatum
- Trauma*

Systemic and miscellaneous disorders

Anaemia* *q.v.*

Central neurological disease causing damage to respiratory centres, e.g.

- Head trauma
- Hyperthermia* *q.v.*
- Hyperthyroidism* (C)
- Hypoxia*
- Metabolic acidosis *q.v.*
- Neuromuscular weakness, e.g. polyradiculoneuritis
- Shock/hypovolaemia* *q.v.*

Acute respiratory distress syndrome

- Aspiration of acidic substances
- Drug reaction
- Inhalation injury
- Lung lobe torsion
- Multiple transfusions
- Pancreatitis
- Sepsis
- Shock
- Surgery
- Trauma

2.3.2 Pallor**Anaemia q.v.****Decreased peripheral perfusion**

- Shock *q.v.*
- Syncope
- Vasoconstriction

Drugs/toxins

- Adder bites
- Baclofen
- Diclofenac sodium
- Ibuprofen
- Ivermectin
- Metaldehyde
- Naproxen
- Paracetamol
- Vitamin D rodenticides

2.3.3 Shock**Cardiogenic****Decreased systolic function**
Dilated cardiomyopathy*

Drugs/toxins, e.g.

- Doxorubicin

Myocardial infarction

Myocarditis

Decreased ventricular filling

Hypertrophic cardiomyopathy* (C)

Pericardial effusion/tamponade*

Restrictive cardiomyopathy* (C)

Restrictive pericarditis

Obstruction

Heartworm disease

Intracardiac mass

Thrombosis

Severe arrhythmia q.v.

Valve disease

Severe myxomatous degeneration of mitral valve* (D)

Rupture of chordae tendinae

Distributive

Anaphylactic

Septic

Hypovolaemic

Haemorrhage* *q.v.*

Hypoadrenocorticism (D)

Dehydration, e.g.

Diabetic ketoacidosis*

Diarrhoea* *q.v.*

Prolonged use of diuretics

Renal disease* *q.v.*

Vomiting* *q.v.*

Hipoproteinaemia/plasma loss, e.g.

Abdominal surgery

Ascites *q.v.*

Burns

Peripheral oedema *q.v.*

Pleural effusion

Hypoxaemic

- Anaemia* *q.v.*
- Respiratory disease* *q.v.*
- Toxins
 - Carbon monoxide
 - Paracetamol

Metabolic

- Heat stroke*
- Hypoglycaemia
- Sepsis*
- Toxins, e.g.
 - Cyanide

Neurogenic

- Acute central nervous system disease
- Electrocution
- Heat stroke

2.3.4 Cyanosis

PERIPHERAL

Arterial obstruction, e.g.

Aortic thromboembolism* (C)

Vasoconstriction

- Hypothermia* *q.v.*
- Reduced cardiac output*
- Shock* *q.v.*

Venous obstruction, e.g.

- Right-sided heart failure*
- Thrombophlebitis
- Tourniquet

CENTRAL

Drugs/toxins

- Baclofen
- Blue-green algae

Loperamide
Metaldehyde
Paracetamol (and other causes of methaemoglobinaemia)
Paraquat
Theobromine

Hypoxaemia

Cardiovascular disease (anatomic shunts), e.g.

Pulmonary arteriovenous fistula
Reverse-shunting patent ductus arteriosus
Reverse-shunting ventricular septal defect
Tetralogy of Fallot

Haemoglobin abnormalities

Reduced inspired oxygen

Altitude
Anaesthetic

Respiratory disease

Hypoventilation

- Pleural effusion* *q.v.*
- Pneumothorax* *q.v.*
- Respiratory muscle failure
- Toxicity

Obstruction

- Brachycephalic obstructive airway syndrome
- Foreign body
 - Laryngeal
 - Tracheal
- Large mass in airway, e.g.
 - Abscess
 - Neoplasia
 - Parasite
- Laryngeal paralysis*

Ventilation–perfusion mismatch

- Acute respiratory distress syndrome
- Chronic obstructive pulmonary disease*
- Pneumonia
- Pulmonary inflammatory disease
- Pulmonary neoplasia*

- Pulmonary oedema* *q.v.*
- Pulmonary thromboembolism

2.3.5 Ascites (see Section 3.7.10 for full listing)

Bile
Blood
Chyle
Exudate
Transudate/modified transudate
Urine

2.3.6 Abnormal respiratory sounds

Crackles

Exudate in airways*
Haemorrhage in airways
Pulmonary fibrosis
Pulmonary oedema* *q.v.*

Stertor

Nasopharyngeal obstruction, e.g.
Brachycephalic obstructive airway syndrome
Foreign body*
Neoplasia

Stridor

Upper airway obstruction
Brachycephalic obstructive airway syndrome
Laryngeal obstruction, e.g.

- Foreign body
- Laryngospasm
- Neoplasia
- Oedema
- Paralysis*

Tracheal obstruction, e.g.

- Collapse*
- Extraluminal compression

- Exudate
- Foreign body
- Haemorrhage
- Neoplasia
- Stenosis

Wheezes

Airway narrowing, e.g.

Bronchoconstriction*

Extraluminal compression

Exudate in airways*

Masses in airways

2.3.7 Abnormal heart sounds

TRANSIENT HEART SOUNDS (HEART SOUNDS OF SHORT DURATION)

Loud S1

Anaemia* *q.v.*

Intensity varies with arrhythmias, e.g.

- Atrial fibrillation
- Heart block
- Sinus arrhythmia*
- Ventricular premature depolarisations*

High sympathetic tone*

Mitral insufficiency*

Systemic hypertension* *q.v.*

Tachycardia* *q.v.*

Thin animals*

Young animals*

Quiet S1

Decreased myocardial contractility, e.g.

- Dilated cardiomyopathy*

Diaphragmatic hernia*

Emphysema

First-degree heart block*

Obesity*
Pericardial effusion *q.v.*
Pleural effusion* *q.v.*
Shock* *q.v.*

Split S1

Bundle branch block
Cardiac pacing
Ectopic beats*
Physiological in healthy large-breed dogs*

Note: A split S1 should be differentiated from presystolic gallop, ejection sounds and diastolic clicks.

Loud S2

Anaemia* *q.v.*
Fever* *q.v.*
Hyperthyroidism* (C)
Intensity varies with arrhythmias, e.g.

- Atrial fibrillation
- Heart block
- Sinus arrhythmia*
- Ventricular premature depolarisations*

Tachycardia* *q.v.*
Thin animals*
Young animals*

Quiet S2

Decreased myocardial contractility, e.g.

- Dilated cardiomyopathy*

Diaphragmatic hernia*
Emphysema
Obesity*
Pericardial effusion *q.v.*
Pleural effusion* *q.v.*
Thoracic masses*
Shock* *q.v.*

Split S2

Physiological in healthy large-breed dogs*

Aortic valve closure follows pulmonic valve closure (A2 follows P2)

- Aortic stenosis
- Left bundle branch block
- Systemic hypertension
- Ventricular ectopic beats*

Pulmonic valve closure follows aortic valve closure (P2 follows A2)

Left to right intracardiac shunt (atrial septal defect)

- Pulmonary hypertension, e.g.
 - Heartworm disease
- Pulmonic stenosis
- Right bundle branch block
- Ventricular ectopic beats*

Gallop rhythms

Accentuated S3 (protodiastolic)

- Occasionally noted in healthy animals
- on phonocardiography
- Anaemia* *q.v.*
- Hyperthyroidism* (C)
- Mitral regurgitation*
- Myocardial dysfunction*
- Patent ductus arteriosus
- Septal defects

Accentuated S4 (presystolic)

- Inaudible in healthy animals, but may be noted
- on phonocardiography
- Hyperthyroidism* (C)
- Hypertrophic cardiomyopathy* (C)
- Marked left ventricular hypertrophy
- Profound heart failure following rupture of chordae tendinae

Early diastolic sounds

- Opening snaps (rare)
 - Mitral valve stenosis
- Pericardial knocks
 - Constrictive pericarditis
- Plops
 - Mobile atrial tumours

Ejection sounds (high frequency sounds in early diastole)

- Aortic stenosis
- Dilatation of the great vessels
- Heartworm disease
- Hypertension* *q.v.*
- Opening of abnormal semilunar valves
- Pulmonic stenosis
- Tetralogy of Fallot

Systolic clicks (short, mid- to high-frequency sounds in mid to late systole)

- Early degenerative valvular disease

MURMURS (HEART SOUNDS OF LONGER DURATION ARISING FROM TURBULENT BLOOD FLOW)**Innocent murmurs*****Physiological murmurs**

- Anaemia* *q.v.*
- Fever* *q.v.*
- Hypertension* *q.v.*
- Hyperthyroidism* (C)
- Pregnancy*

Murmurs associated with cardiovascular disease**Continuous**

- Coronary arteriovenous fistula
- Coronary artery or ruptured sinus aneurysm communicating directly with right atrium
- Patent ductus arteriosus
- Pulmonary arteriovenous fistula

Diastolic

- Aortic insufficiency (congenital or associated with bacterial endocarditis)
- Mitral stenosis

Systolic

- Holosystolic crescendo-decrescendo
 - Aortic stenosis
 - Pulmonic stenosis
 - Ventricular septal defect

Holosystolic plateau-shaped

- Mitral regurgitation*
- Tricuspid regurgitation*
- Ventricular septal defect

2.3.8 Abnormalities in heart rate

BRADYCARDIA

Normal in athletic dogs, during rest/sleep

Cardiac disease/arrhythmias *q.v.*

CNS disease

Hypothermia

Severe systemic disease

Drugs/toxins

Adder bites

Amiodarone

Antidysrhythmics, e.g. beta blockers

Atenolol

Baclofen

Bethanechol

Cannabis

Carbamate

Clonidine

Daffodil

Diltiazem

Fentanyl

Glyphosate

Hypertonic saline

Ivermectin

Lignocaine

Loperamide

Medetomidine

Mexiletine

Organophosphates

Paraquat

Phenoxy acid herbicides

Propranolol

Pyridostigmine

Rhododendron
Sotalol
Theobromine
Timolol maleate
Verapamil
Vitamin D rodenticides
Xylazine
Yew

Increased vagal tone*, e.g.

Gastrointestinal disease* *q.v.*
Respiratory disease* *q.v.*

Metabolic disease

Hyperkalaemia *q.v.*
Hypoadrenocorticism
Hypoglycaemia *q.v.*
Hypothyroidism*
Uraemia*

TACHYCARDIA

Drugs/toxins

Adder bites
Adrenaline
Atropine
Baclofen
Blue-green algae
Cannabis
Dinoprost tromethamine
Dobutamine
Dopamine
Doxapram
Doxorubicin
Ethylene glycol
Glyceryl trinitrate
Glycopyrronium bromide
Glyphosate
Hydralazine
Ibuprofen
Isosorbide dinitrate

Ketamine
Levothyroxine
Metaldehyde
Paracetamol
Paraquat
Petroleum distillates
Phenoxy acid herbicides
Phenoxybenzamine
Propantheline bromide
Pyrethrins/pyrethroids
Salbutamol
Selective serotonin reuptake inhibitors
Terbutaline
Terfenadine
Theobromine
Theophylline
Tricyclic antidepressants
Verapamil
Vitamin D rodenticides

Sinus tachycardia

Physiological

Excitement*
Exercise*
Fear*
Pain*

Pathological

Heart failure*
Respiratory disease*
Shock*
Systemic disease

- Anaemia* *q.v.*
- Fever* *q.v.*
- Hyperthyroidism (C)*
- Hypoxia*
- Sepsis*

Other types of supraventricular tachycardia* *q.v.*

Ventricular tachycardia* *q.v.*

2.3.9 Jugular distension/hepatojugular reflux

Cardiac disease resulting in right-sided heart failure*

Fluid volume overload, e.g.

- Iatrogenic*

Pericardial disease

2.3.10 Alterations in arterial pulse

Hyperkinetic (bounding) pulse

Anaemia* *q.v.*

Arteriovenous fistula

Bradycardia* *q.v.*

Decreased diastolic blood pressure

- Aortic insufficiency
- Shunting lesions, e.g.
 - Increased stroke volume
 - Increased systolic blood pressure
 - Patent ductus arteriosus

Fever* *q.v.*

Hyperthyroidism* (c)

Hypokinetic (weak) pulse

Aortic stenosis

Increased peripheral resistance

Regional loss of pulse (see succeeding text)

Small stroke volume, e.g.

- Hypovolaemia* *q.v.*
- Left-sided heart failure*

Tachycardia *q.v.*

Toxins

- Alphachloralose
- Anticoagulant rodenticides

Pulsus alternans

Myocardial failure

Tachyarrhythmias *q.v.*

Pulsus bigeminus

Ventricular bigeminy

Pulse deficits

Tachyarrhythmias *q.v.*

Pulsus paradoxus

Exaggerated in pericardial effusion (with cardiac tamponade)

Physiological

Regional loss of pulse

Infectious embolus

Neoplastic embolus

Thromboembolism*

2.4 Dermatological signs

2.4.1 Scaling

Exfoliative dermatoses

Contact dermatitis*

Drug eruption

Epitheliotrophic lymphoma

Feline immunodeficiency virus* (C)

Feline leukaemia virus* (C)

Parapsoriasis

Pemphigus foliaceus

Systemic lupus erythematosus

Thymoma

Toxic epidermal necrolysis

Primary/inherited disorders of keratinisation

Acne*

Canine primary idiopathic seborrhoea (D)

Ear margin dermatosis

Epidermal dysplasia (Armadillo Westie syndrome) (D)

Feline idiopathic facial dermatitis (C)

Feline primary idiopathic seborrhoea (C)

Follicular dysplasia
Follicular hyperkeratosis
Follicular parakeratosis
Footpad hyperkeratosis
Ichthyosis
Lethal acrodermatitis
Lichenoid psoriasisiform dermatosis
Nasal hyperkeratosis*
Nasodigital hyperkeratosis
Schnauzer comedo syndrome (D)
Sebaceous adenitis
Tail gland hyperplasia*
Vitamin-A-responsive dermatosis
Zinc-responsive dermatosis

Secondary scaling

Allergic/immune-mediated

Atopy*
Contact hypersensitivity
Drug hypersensitivity
Food hypersensitivity*
Hormonal hypersensitivity
Pemphigus foliaceus

Environmental

Low humidity
Physical/chemical damage

Infectious/parasitic

Bacterial pyoderma
Cheyletiellosis*
Cowpox virus (C)
Demodectosis*
Dermatophytosis*
Endoparasites*
Fleas*
Leishmaniasis
Malassezia spp*
Pediculosis*
Pyoderma*
Scabies* (D)

Metabolic/endocrine

Diabetic dermatopathy
Growth hormone-responsive dermatosis
Hepatic disease
Hyperadrenocorticism
Hyperandrogenism
Hyperthyroidism* (C)
Hypopituitarism
Hypothyroidism* (D)
Idiopathic male feminising syndrome
Intestinal disease
Necrolytic migratory erythema
Oestrogen-responsive dermatosis
Pancreatic disease
Renal disease
Sertoli cell tumour
Sex hormone abnormalities
Superficial necrolytic dermatitis

- Glucagonoma
- Hepatocutaneous syndrome

Testosterone-responsive dermatosis

Neoplastic

Epitheliotrophic lymphoma

Nutritional

Dietary deficiency of essential fatty acids
Malabsorption/malnutrition of essential fatty acids

**2.4.2 Pustules and papules
(including miliary dermatitis)****Primary immune-mediated**

Bullous pemphigoid
Pemphigus erythematosus
Pemphigus foliaceus
Pemphigus vegetans
Pemphigus vulgaris
Systemic lupus erythematosus

Immune-mediated diseases causing secondary pyoderma

Atopy*
Contact allergy*
Food hypersensitivity*
Hypereosinophilic syndrome

Infectious/parasitic diseases causing secondary pyoderma

Cheyletiellosis
Demodectosis*
Dermatophilosis
Dermatophytosis*
External parasite bites*, e.g.
• Fleas
• Mosquitoes
Feline immunodeficiency virus*
Feline leukaemia virus*
Lynxacarus radovskyi
Malassezia spp.*
Notoedres cati
Pediculosis*
Sarcoptic mange*
Superficial pustular dermatitis*
Trombiculiasis*

Miscellaneous

Canine linear IgA pustular dermatosis (D)
Contact irritation*
Drug eruptions
Juvenile cellulitis
Sterile eosinophilic pustular dermatosis
Subcorneal pustular dermatosis

Neoplastic

Epitheliotrophic lymphoma
Mast cell tumour*

Nutritional

Biotin deficiency
Essential fatty acid deficiency

2.4.3 Nodules

Inflammation

Angiogenic oedema
Calcinosis circumscripta
Calcinosis cutis
Infectious

- Bacterial*
- Fungal
- Parasitic

Granuloma, e.g.

- Eosinophilic*
- Insect bite*

Histiocytosis
Nodular cutaneous amyloidosis
Nodular dermatofibrosis
Panniculitis
Sterile nodular granuloma
Urticaria*
Xanthoma

Neoplasia

Epithelial

Apocrine adenoma/carcinoma*
Basal cell tumour*
Ceruminous adenoma/carcinoma*
Keratoacanthoma*
Papilloma*
Perianal gland adenoma/carcinoma*
Pilomatrixoma*
Sebaceous adenoma/carcinoma*
Squamous cell carcinoma*
Sweat gland tumours*
Trichoepithelioma*

Melanocyte

Melanoma

Round cell

Lymphoma

- Epitheliotrophic
- Lymphomatoid granulomatosis
- Non-epitheliotrophic

Histiocytic sarcoma

Histiocytoma*

Mast cell tumour*

Plasmacytoma*

Transmissible venereal tumour

Mesenchymal

Benign fibrous histiocytoma

Dermatofibroma

Fibrolipoma

Fibroma

Fibropapilloma

Fibrosarcoma

Haemangioma/sarcoma

Haemangiopericytoma

Leiomyoma/sarcoma

Lipoma/sarcoma*

Lymphangioma/sarcoma

Myxosarcoma

Schwannoma

*Metastatic***Non-neoplastic, non-inflammatory**

Benign nodular sebaceous hyperplasia

Cysts*

- Dermoid
- Epidermoid
- Follicular

Fibroadnexal dysplasia

Haematoma*

Naevi/hamartoma

- Collagenous
- Follicular
- Sebaceous
- Vascular

Seroma*
Skin polyp*
Urticaria pigmentosa

2.4.4 Pigmentation disorders (coat or skin)

HYPOPIGMENTATION

Generalised

Age-related greying*
Albinism
Canine cyclic haematopoiesis (D)
Chediak–Higashi syndrome (C)
Mucocutaneous hypopigmentation
Nutritional deficiencies

- Copper
- Lysine
- Pantothenic acid
- Protein
- Pyridoxine
- Zinc

Oculocutaneous albinism
Piebaldism
Tyrosinase deficiency
Waardenburg syndrome
Drugs

Localised

Idiopathic
Periocular leukotrichia/Aguirre syndrome
Seasonal nasal hypopigmentation*

Immune-mediated

Sutton's halo
Uveodermatological syndrome
Vitiligo

Infectious

Aspergillosis
Leishmaniasis

Neoplastic

Basal cell tumour
Epitheliotrophic lymphoma
Gastric carcinoma
Mammary adenocarcinoma*
Melanoma
Squamous cell carcinoma

Post-inflammatory

Bullous pemphigoid
Inflammatory dermatitis* *q.v.*
Lupus erythematosus

Trauma

Burns
Chemical
Physical*
Radiation
Surgical*

HYPERPIGMENTATION**Drugs**

- Minocycline
- Mitotane

Focal

Acanthosis nigra
Demodectosis*
Dermatophytosis*
Lentigo
Naevus
Neoplasia*
Post-inflammatory
Pyoderma*
Trauma*

Generalised/diffuse

Alopecia X
Demodectosis*
Endocrine disease

- Adrenal sex-hormone dermatosis

- Growth hormone-responsive dermatosis
- Hyperadrenocorticism
- Hyperoestrogenism
- Hypothyroidism* (D)

Iatrogenic

- Prolonged glucocorticoid administration

Malassezia spp.*

Recurrent flank alopecia

Ultraviolet irradiation of alopecic regions

Multifocal

Bowen's disease (C)

Demodecosis*

Dermatophytosis*

Lentigines

Melanoderma

Naevus

Post-inflammatory

Pyoderma*

Tumours*

Urticaria pigmentosa

2.4.5 Alopecia

Failure of hair growth

Paraneoplastic alopecia

Endocrine disease

Diabetes mellitus*

Hyperadrenocorticism

Hypothyroidism* (D)

Follicular diseases

Anagen defluvium

- Cancer chemotherapy
- Endocrine disease*
- Infection
- Metabolic disease*

Colour-dilution alopecia

Congenital follicular dysplasias

Congenital hypotrichosis
Dark hair follicular dystrophy

Hair cycle arrest alopecia

Endocrine disease

- Alopecia X
 - Adrenal sex hormone-responsive dermatosis
 - Castration-responsive dermatosis
 - Growth hormone-responsive dermatosis
 - Oestrogen responsive dermatosis
- Testosterone-responsive dermatosis
 - Hyperadrenocorticism
 - Hyperoestrogenism
 - Hypothyroidism* (D)

Idiopathic cyclic flank alopecia

Pattern baldness

Post-clipping

Telogen defluvium*

- Stress, e.g.
 - Anaesthesia
 - Pregnancy
 - Shock *q.v.*
 - Surgery
 - Systemic illness

Systemic diseases

Chronic hepatic disease *q.v.*

End-stage renal disease *q.v.*

Feline immunodeficiency virus (C)

Feline leukaemia virus (C)

Damage to hair follicle

Secondary to pruritus* *q.v.*

Drugs

- Carbimazole

Follicular infections

Bacterial folliculitis*

Demodectis*

Dermatophytosis*

Immune-mediated disease

- Alopecia areata
- Idiopathic lymphocytic mural folliculitis
- Pseudopelade
- Sebaceous adenitis

Miscellaneous

- Alopecia mucinosis
- Feline-acquired symmetric alopecia (C)
- Feline pinnal alopecia* (C)
- Feline pre-auricular alopecia (normal)
- Follicular lipidosis of Rottweilers (D)
- Medullary trichomalacia
- Psychogenic alopecia*
- Short hair syndrome of Silky breeds (D)

Neoplasia****Nutritional***

- Zinc deficiency
- Zinc-responsive dermatosis

Trauma/physical

- Injection site reaction
- Over-grooming
- Sensory neuropathy
- Traction alopecia
- Trichoptilosis
- Tricorrhexis nodosa

2.4.6 Erosive/ulcerative skin disease

Drugs/toxins

- ACE inhibitors
- Diuretics
- Fenbendazole
- Imodium
- Itraconazole
- Ivermectin
- Metoclopramide

Metronidazole
Phenobarbitone
Phenylbutazone
Thallium

Idiopathic

Feline idiopathic ulcerative dermatosis

Immune-mediated

Bullous pemphigoid
Discoid lupus erythematosus
Epidermolysis bullosa acquisita
Erythema multiforme
Mucous membrane pemphigoid
Perianal fistulae
Plasma cell pododermatitis
Systemic lupus erythematosus
Toxic epidermal necrolysis
Ulcerative disease of Shetland Sheepdog
and Rough Collie (D)

Infection

Antibiotic responsive ulcerative
dermatoses
Cowpox virus (C)

Neoplasia*

Physical

Burns
Frostbite
Radiation
Trauma

Vasculitis

Idiopathic
Immune-mediated
Infectious

2.4.7 Otitis externa

Primary causes

Disorders of keratinisation

Primary seborrhoea
Sebaceous adenitis
Vitamin-A-responsive dermatosis

Endocrine, e.g.

Hyperadrenocorticism
Hypothyroidism* (D)

Hypersensitivity

Atopy*
Contact allergy*
Drug reactions
Food hypersensitivity*

Immune-mediated

Bullous pemphigoid
Cold agglutinin disease
Drug eruption
Erythema multiforme
Lupus erythematosus
Pemphigus erythematosus
Pemphigus foliaceus
Vasculitis

Infection

Fungal

- Dermatophytosis*
- *Sporothrix schenckii*

Parasites

- Demodectosis*
- Fleas*
- *Otodectes cynotis**
- Pediculosis*
- Sarcoptic mange* (D)
- Trombiculosis*

Pyoderma

Miscellaneous

Abnormal cerumen production
Juvenile cellulitis

Neoplasia

Adenocarcinoma
Adenoma
Papilloma
Squamous cell carcinoma

Physical

Foreign body*

Predisposing factors***Ear conformation/structure***

Ear canal stenosis

- Acquired*
- Inherited

Hypertrichosis*
Neoplasia
Pendulous pinnae* (D)
Polyps*

Excessive moisture

Humidity
Swimming

Iatrogenic***Irritant ear cleaning products***
Overuse of cleaning products
Trauma***Systemic immunosuppression*******Perpetuating factors****

Acquired changes secondary to chronic ear disease

- Fibrosis*
- Hyperplasia*
- Mineralisation*
- Oedema*
- Ulceration*

Bacterial infection*

- *Enterobacter* spp.
- *Proteus* spp.
- *Pseudomonas* spp
- *Staphylococcus intermedius*
- *Streptococcus* spp.

Candidiasis*

Otitis media

2.4.8 Pododermatitis

Asymmetric pododermatitis

Infection

Bacterial*

- *Actinomyces* spp.
- *Nocardia* spp.
- *Proteus* spp.
- *Pseudomonas* spp
- *Staphylococcus intermedius*

Fungal

- Blastomycosis
- Candidiasis
- Cryptococcosis
- Dermatophytosis*
- Eumycotic mycetoma
- *Malassezia** spp.

Parasitic, e.g.

- Demodecosis*

Miscellaneous

Acral lick dermatitis*

Arteriovenous fistula

Calcinosis circumscripta

Foreign body*

Irritant*

Osteomyelitis

Sensory neuropathy

Neoplasia

Trauma

Symmetric pododermatitis

Congenital

Acrodermatitis of Bull Terriers (D)
Familial hyperkeratosis in Irish Terriers (D)
Familial vasculopathy of German Shepherd (D)
Idiopathic footpad hyperkeratosis
Tyrosinaemia
Vasculitis of Jack Russell Terriers (D)

Immunodeficiencies

Acquired
Congenital

Immune-mediated/allergic

Atopy*
Bullous pemphigoid
Cold agglutinins
Contact allergy*
Dermatomyositis (D)
Drug eruption
Food allergy*
Pemphigus foliaceus
Pemphigus vulgaris
Plasma cell pododermatitis (C)
Sterile granuloma/pyogranuloma
Systemic lupus erythematosus
Vasculitis

Infection

Bacterial, e.g.
• *Staphylococcus intermedius*
Fungal, e.g.
• *Malassezia* spp.
Parasitic, e.g.
• Demodecosis
• Hookworm
• Leishmaniasis
• *Pelodera*
Viral
• Distemper* (D)

*Irritant**Metabolic*

- Calcinosis circumscripta
- Superficial necrolytic dermatitis

Miscellaneous

- Dermatofibrosis

*Neoplasia**Nutritional*

- Zinc responsive dermatosis

Psychogenic/neurogenic

- Acral mutilation of German Short-Haired Pointers (D)
- Sensory neuropathy

2.4.9 Disorders of the claws

Drugs/toxins

- Thallotoxicosis

Idiopathic conditions

- Idiopathic onychodystrophy
- Idiopathic onychogryphosis
- Idiopathic onychomadesis

Immune-mediated disease

- Bullous pemphigoid
- Cryoglobulinaemia
- Discoid lupus erythematosus/symmetric lupoid onychodystrophy
- Drug eruption
- Eosinophilic granuloma complex
- Pemphigus complex
- Systemic lupus erythematosus
- Vasculitis

Infection

Bacterial

- Secondary to trauma or virus*

Fungal

- Blastomycosis
- Candidiasis
- Cryptococcosis
- Dermatophytosis
- Geotrichosis
- *Malassezia* spp.
- Sporothricosis

Parasitic

- Ascarids
- Demodectosis
- Hookworm dermatitis

Protozoal

- Leishmaniasis

Viral

- Canine distemper virus* (D)
- Feline immunodeficiency virus* (C)
- Feline leukaemia virus* (C)

Inherited/primary disease

Anonychia (loss of nails)

Dermatomyositis

Epidermolysis bullosa

Naevus

Primary seborrhoea

Supernumerary claws

Metabolic/endocrine disease

Acromegaly

Diabetes mellitus*

Hyperadrenocorticism

Hyperthyroidism* (C)

Hypothyroidism* (D)

Necrolytic migratory erythema

Neoplasia, e.g.

Metastatic lung carcinoma

Squamous cell carcinoma

Nutrition

Lethal acrodermatitis
Zinc responsive dermatosis

Trauma

Irritant chemical*
Physical injury*

Vascular

Disseminated intravascular coagulation
Raynaud-like disease

2.4.10 Anal sac/perianal disease

Perianal/caudal pruritus

Anal sac impaction*
Anal sacculitis*
Atopy*
Flea bite hypersensitivity*
Food hypersensitivity*
Intertrigo*

- Perineal
- Tail fold
- Vulval fold

Parasitism*, e.g.

- Cheyletiellosis
- Sarcoptic mange

Perianal fistula

Anal furunculosis*
Ruptured anal sac abscess*

Perianal swelling

Anal sac abscess*
Anal sac neoplasia*
Perianal adenoma*
Other perianal neoplasia
Perineal hernia*
Rectal prolapse*

2.5 Neurological signs

2.5.1 Abnormal cranial nerve (CN) responses

The anatomical localisation of lesions associated with the abnormal test are listed, together with other disorders that can produce alterations in the cranial nerve tests.

Anisocoria

Abnormal pupil constricted

Corneal ulcers/lacerations

Drugs, e.g.

- Pilocarpine

Horner syndrome

Posterior synechiae

Previous inflammation

Uveitis*

Abnormal pupil dilated

Iris, retina, CN II, CN III

- Chorioretinitis
- Glaucoma
- Iris atrophy/hypoplasia
- Iris trauma
- Posterior synechiae
- Unilateral blindness
- Drugs, e.g.
 - Atropine
 - Phenylephrine

Auditory response reduced

CN VIII

External auditory canal*

Middle* or inner ear

Corneal reflex reduced

Brainstem

CN V

CN VII

Facial asymmetry

Facial paralysis

- CN VII
- Idiopathic neuritis
- Neoplasia of the middle ear
- Otitis media*

Masticatory muscle wastage

- CN V
 - Idiopathic trigeminal neuritis
 - Malignant trigeminal nerve sheath tumour
- Masticatory myositis

Gag reflex reduced

Brainstem

CN IX

CN X

Jaw tone reduced/inability to close jaw

CN V

- Idiopathic trigeminal neuritis
- Lymphoma*
- Neosporosis

Orthopaedic or muscular disease

Lack of response to non-irritant smell

CN I

Nasal disease

Menace response reduced

Brainstem

Cerebellum

CN II

CN VII

Forebrain

Immature animal

Retina

Palpebral reflex reduced

Brainstem

CN V

CN VII

Pupillary light reflex reduced

Brainstem
CN II
CN III
Retina

Response to stimulation of nasal mucosa reduced

Brainstem
CN V
Forebrain

Response to vagal manoeuvres reduced

CN X

Spontaneous nystagmus

Brainstem
CN VIII
Toxic, e.g.

- Cannabis
- Metaldehyde

Vestibular disease *q.v.*, e.g.

- Canine idiopathic geriatric vestibular disease*
- Congenital vestibular disease
- Middle ear disease

Strabismus

Ventrolateral
CN III

Dorsolateral
CN IV

Medial
CN VI

Vestibulo-ocular reflex reduced

Brainstem
CN III
CN IV
CN VI
CN VIII

Diseases of CN V

- Idiopathic trigeminal neuritis
- Infiltrating neoplasia, e.g.
 - Lymphoma
 - Nerve sheath tumours

Diseases of CN VII

- Idiopathic
- Insulinoma
- Otitis media/interna
- Trauma of middle ear
- Tumour of middle ear

2.5.2 Vestibular disease

(Signs include head tilt, nystagmus, circling, leaning, falling and rolling)

PERIPHERAL VESTIBULAR SYSTEM

Congenital vestibular disease

Drugs/toxins

Antibiotics

- Aminoglycosides
- Amphotericin B
- Ampicillin
- Bacitracin
- Chloramphenicol
- Colistin
- Erythromycin
- Griseofulvin
- Hygromycin B
- Metronidazole
- Minocycline
- Polymixin B
- Tetracyclines
- Vancomycin

Antiseptics

- Benzalkonium chloride
- Benzethonium chloride

Cetrimide
Chlorhexidine
Ethanol
Iodine
Iodophores

Cancer chemotherapeutics

Actinomycin
Cisplatin
Cyclophosphamide
Vinblastine
Vincristine

Diuretics

Bumetanide
Ethacrynic acid
Frusemide

Metals/heavy metals

Arsenic
Gold salts
Lead
Mercury
Triethyl(trimethyl tin)

Miscellaneous

Ceruminolytic agents
Danazol
Detergents
Digoxin
Dimethylsulphoxide
Diphenylhydrazine
Insulin
Mexiletine
Potassium bromide
Prednisolone
Propylene glycol
Quinidine
Salicylates

Idiopathic conditions

Idiopathic geriatric vestibular disease*

Infection

Extension of otitis externa* *q.v.*

Foreign bodies*

Haematogenous spread of infection

Otitis media/interna*

Polyps*

Metabolic disease

Hypothyroidism* (D)

Neoplasia

Ceruminous gland adenocarcinoma

Chondrosarcoma

Fibrosarcoma

Osteosarcoma

Schwannoma

Squamous cell carcinoma

Trauma**CENTRAL VESTIBULAR SYSTEM****Congenital conditions**

Chiari-like malformation

Hydrocephalus

Degeneration

Lysosomal storage disorders

Drugs/toxins

Metronidazole

Idiopathic conditions

Arachnoid cysts

Immune-mediated/Infection

Feline spongiform encephalopathy (C)

Meningoencephalitis

Metabolic disease

Electrolyte abnormalities* *q.v.*

Hepatic encephalopathy* *q.v.*

Uraemic encephalopathy* *q.v.*

Neoplasia

Choroid plexus tumours
Dermoid cyst
Epidermoid cyst
Glioma
Lymphoma
Medulloblastoma
Meningioma
Metastatic tumour

Nutrition

Thiamine deficiency
Trauma

Vascular disorders

Cerebrovascular accident

2.5.3 Horner's syndrome

First order (hypothalamus, rostral midbrain, spinal cord to T3)

Intracranial disease, e.g.

- Neoplasia

Spinal disease *q.v.*
Thoracic disease, e.g.

- Cranial mediastinal mass

Second order (pre-ganglionic) (T1-T3, vagosympathetic trunk, caudal and cranial cervical ganglia)

Brachial plexus avulsion
Cervical soft tissue disease, e.g.

- Mass
- Neoplasia
- Trauma

Cervical surgery, e.g.

- Thyroidectomy

Third order (post-ganglionic) (middle ear, cranial cavity, eye)

Feline immunodeficiency virus* (C)

Iatrogenic, e.g.

- Bulla osteotomy

Idiopathic*

Middle ear

- Mass

- Neoplasia

Otitis media/interna*

Retrobulbar

- Injury

- Mass*

- Neoplasia

2.5.4 Hemineglect syndrome (Forebrain dysfunction q.v.)

2.5.5 Spinal disorders

C1–C5

Acute

Atlantoaxial subluxation

Cervical spondylomyelopathy (D)

Degenerative disc disease* (D)

Discospondylitis

Fibrocartilaginous embolism*

Fracture*

Granulomatous meningoencephalomyelitis

Haematoma

Ischaemic myelopathy

Luxation

Neoplasia

Chronic

Atlanto-occipital dysplasia

Atlantoaxial subluxation

Calcinosis circumscripta

Cervical fibrotic stenosis

Cervical spondylomyelopathy* (D)

Feline infectious peritonitis (C)

Hypervitaminosis A
Neoplasia
Spinal arachnoid cysts
Synovial cysts
Syringohydromyelia*

C6-T2

Acute

Brachial plexus avulsion
Cervical spondylomyopathy* (D)
Degenerative disc disease* (D)
Discospondylitis
Fibrocartilaginous embolism*
Fracture*
Granulomatous meningoencephalomyelitis
Haematoma
Luxation
Neoplasia

Chronic

Cervical spondylomyopathy* (D)
Dermoid sinus
Neoplasia
Spinal arachnoid cysts
Synovial cysts

T3-L3

Acute

Ascending myelomalacia
Degenerative disc disease* (D)
Discospondylitis
Fibrocartilaginous embolism
Fracture*
Granulomatous meningoencephalomyelitis
Luxation
Neoplasia

Chronic

Calcinosis circumscripta
Degenerative disc disease* (D)

Degenerative myelopathy*

Neoplasia

Spinal arachnoid cyst

Synovial cysts

I4-S3

Acute

Ascending myelomalacia

Cauda equina neuritis* (D)

Degenerative disc disease* (D)

Discospondylitis

Fibrocartilaginous embolism

Fracture*

Granulomatous meningoencephalomyelitis

Ischaemic neuromyopathy

Luxation

Neoplasia

Psoas muscle injury

Chronic

Degenerative myelopathy*

Dermoid sinus

Lumbosacral disc disease* (D)

Neoplasia

Sacral osteochondritis dissecans

Sacrocaudal dysgenesis

Spina bifida

Tethered cord syndrome

2.6 Ocular signs

2.6.1 Red eye

CONJUNCTIVITIS

Chemical

Acid

Alkali

Antiseptics
Shampoos

Immune-mediated

Allergic
Arthropod bites*
Atopy*
Drug reaction
Food hypersensitivity*
Idiopathic
Keratoconjunctivitis sicca*

Infectious

Bacterial*
Fungal, e.g.

- Blastomycosis

Mycoplasmal
Parasitic, e.g.

- *Thelazia* spp.

Rickettsial
Viral, e.g.

- Canine distemper virus* (D)

Neurological

Lack of blink reflex

- Lesions of facial nerve *q.v.*
- Lesions of trigeminal nerve *q.v.*

Lack of tear production

- Neurogenic keratoconjunctivitis sicca

Physical

Cilia*
Dust*
Foreign body*
Masses*
Poor eyelid anatomy*

- Ectropion
- Entropion

Radiation therapy

Neoplastic, e.g.

Mast cell tumour
Melanoma
Squamous cell carcinoma

Systemic diseases

Hepatozoonosis
Leishmaniasis
Listeriosis
Multiple myeloma
Systemic histiocytosis
Tyrosinaemia (D)

ANTERIOR UVEITIS**Idiopathic****Ionising radiation****Infection***Algae*

Protothecosis

Bacteria

Bartonella

Borreliosis

Brucellosis (D)

Leptospirosis

Septicaemia

- Abscesses*
- Bacterial endocarditis
- Dental infections*
- Neonatal umbilical infections
- Prostatitis*
- Pyelonephritis
- Pyometra*
- Pyothorax

Fungal

Blastomycosis

Candidiasis

Coccidioidomycosis
Cryptococcosis
Histoplasmosis

Parasitic

Angiostrongylosis
Baylisascaris procyonis
Diptera
Dirofilariasis
Toxocariasis

Protozoa

Leishmaniasis
Neosporosis (D)
Toxoplasmosis

Rickettsia

Ehrlichiosis
Rocky Mountain Spotted Fever

Viruses

Canine adenovirus-1 (D)
Canine distemper virus
Canine herpes virus (D)
Feline immunodeficiency virus (C)*
Feline infectious peritonitis (C)*
Feline leukaemia virus (C)*
Rabies

Neoplasia

Adenocarcinomas
Ciliary body
Ciliary body adenoma
Medulloepitheliomas
Melanoma
Metastatic neoplasia, especially

- Haemangiosarcoma
- Lymphoma

Sarcoma
Systemic histiocytosis

Non-infectious inflammatory

Lens-associated anterior uveitis

- Cataract*
- Luxation*
- Penetrating trauma*

Granulomatous meningoencephalomyelitis

Idiopathic

Immune-mediated vasculitis

Pigmentary uveitis

Uveodermatological syndrome

Systemic, e.g.

Coagulopathy

Hyperlipidaemia *q.v.*

Systemic hypertension* *q.v.*

Toxaemia

Trauma

Blunt trauma*

Penetrating trauma*/intraocular
foreign bodies

Drugs, e.g.

- Miotics

BULBAR HYPERAEMIA/VASCULAR CONGESTION

Anterior scleritis

Trauma*

Episcleritis

Nodular

Simple

Glaucoma

Primary

Goniodysgenesis

Primary open angle glaucoma

Secondary

Cataract* *q.v.*

Drugs

- Atropine
- Sildenafil

Intraocular haemorrhage* *q.v.*

Lens luxation*

Neoplasia

Neovascular tissue overlying pectinate ligament

Pigmentary glaucoma

Trauma

Uveitis* *q.v.*

Vitreous prolapse post-lentectomy

Cornea Red

Haemorrhage

Granulation tissue

Neovascularisation

Intraocular Red Eye

Anterior uveitis

Hyphaema

Iris mass

Retinal detachment

Vitreal haemorrhage

2.6.2 Corneal opacification

Corneal oedema

Anterior uveitis* *q.v.*

Canine adenovirus-1 (D)

Corneal ulceration* *q.v.*

Drugs/toxins

- Tocainide

Endophthalmitis

Endothelial dystrophy

Glaucoma *q.v.*

Historic use of canine adenovirus-1 live vaccine

Intraocular neoplasia

Mechanical trauma*/iatrogenic

Neovascularisation
Persistent pupillary membranes

Corneal vascularisation

Endophthalmitis
Glaucoma *q.v.*
Intraocular neoplasia
Keratitis*
Pannus*
Uveitis* *q.v.*

Miscellaneous

Calcium deposition
Cellular infiltration
Degenerative changes
Foreign bodies*
Lipid deposition
Neoplastic infiltration
Scarring*
Xerosis

Pigmentation

Anterior synechiae
Chronic corneal insult*
Congenital endothelial pigmentation
Corneal sequestrum
Limbal melanoma
Persistent pupillary membranes
Pigmentary glaucoma

2.6.3 Corneal ulceration/erosion

Degeneration

Corneal calcific degeneration
Lipid keratopathy

Dystrophic

Bullous keratopathy
Corneal endothelial dystrophy

Corneal sequestrum (C)

Epithelial basement membrane dystrophy (indolent ulcer)

Infection

Bacterial (secondary invaders)

Bacillus spp.

Corynebacterium spp.

Escherichia coli

Pseudomonas spp.

Staphylococcus spp.

Streptococcus spp.

Fungal

Acremonium spp.

Alternaria spp.

Aspergillosis

Candidiasis

Cephalosporium spp.

Curvalia spp.

Pseudallescheria spp.

Scedosporium spp.

Protozoal

Viral

Feline herpes virus* (C)

Inflammation/immune-mediated

Feline eosinophilic keratitis

Keratoconjunctivitis sicca*

Punctate keratopathy (D)

Mechanical/irritant trauma

Aberrant hairs*

Distichiasis*

Ectopic cilia*

Eyelid abnormalities*

- Ectropion

- Entropion

Heat

Irritant chemicals

Self-trauma*
Shampoos
Smoke*
Trichiasis*
Ultraviolet light*

Neurological conditions

Ionising radiation
Lack of blink reflex

- Lesions of facial nerve *q.v.*
- Lesions of trigeminal nerve *q.v.*

Lack of tear production

- Neurogenic keratoconjunctivitis sicca

2.6.4 Lens lesions

Cataract

Age-related*
Electrocution
Glaucoma *q.v.*
Lens luxation (see succeeding text)
Non-hereditary developmental
Post-inflammation
Radiation
Retinal degeneration

Drugs/toxins

Diazoxide
Dimethyl sulfoxide
Dinitrophenol
Hydroxymethylglutaryl-coenzyme A reductase inhibitors
Ketoconazole
Pefloxacin
Phenylpiperazine
Progesterone-based contraceptives
Sulfonylurea glimepiride
Topical dexamethasone

Hereditary, e.g.

Congenital with microphthalmos and rotatory nystagmus

Early onset and progressive
Posterior polar subcapsular cataract

Metabolic

Diabetes mellitus*
Hypocalcaemia (primary hypoparathyroidism)
Nutritional secondary hyperparathyroidism

Nutritional

Hand rearing on milk substitutes

*Traumatic**

Blunt
Penetrating

Luxation/subluxation

Primary

Secondary

Chronic uveitis *q.v.*
Glaucoma *q.v.*
Lens shape/size abnormalities
Trauma

2.6.5 Retinal lesions

Retinal detachment

Congenital, e.g.

Collie eye anomaly
Persistent hyperplastic primary vitreous and retinal dysplasia

Iatrogenic

Complication of lens surgery

Space-occupying lesions

Extraocular
Intraocular

Systemic disease

Hypertension* *q.v.*
Severe systemic inflammatory disease
Uveodermatological syndrome

*Trauma**

Swollen optic disc

Disc oedema

Glaucoma *q.v.*

Post-operative hypotony

Uveitis *q.v.*

Neoplasia

Metastatic

Primary

Optic neuritis

Inflammatory

- Granulomatous meningoencephalomyelitis

Infectious

- Blastomycosis
- Canine distemper virus* (D)
- Cryptococcosis
- Histoplasmosis
- Toxoplasmosis

Idiopathic

Local disease

- Orbital abscess*
- Orbital cellulitis*
- Neoplasia

Trauma*

Toxins

Papilloedema, e.g.

Acute glaucoma

Hypertension *q.v.*

Neoplasia of optic nerve

Orbital space-occupying lesion

Raised intracranial pressure

- Brain tumours
- Intracranial haemorrhage

Pseudopapilloedema

Congenital defects

Retinal haemorrhage*, e.g.

- Coagulopathy
- Hypertensive retinopathy
- Hyperviscosity
- Inflammatory/infectious chorioretinitis
- Neoplastic chorioretinitis

2.6.6 Intraocular haemorrhage/hyphaema**Chronic glaucoma****Coagulopathy****Congenital disease**

- Collie eye anomaly
- Persistent hyaloid artery
- Persistent hyperplastic primary vitreous
- Vitreoretinal dysplasia

Hyperviscosity syndrome

- Hyperglobulinaemia
- Polycythaemia *q.v.*

Iatrogenic

- Post-surgery

Inflammation, e.g.

- Uveitis

Neoplasia**Neovascularisation**

- Retinal
- Uveal

Retinal detachment *q.v.***Systemic hypertension* *q.v.*****Trauma***

2.6.7 Abnormal appearance of anterior chamber

Anterior synechia

Anterior uveitis q.v.

Congenital lesions

Coloboma

Iris cysts

Persistent pupillary membranes

Hyphaema q.v.

Hypopyon

Deep corneal ulceration

Uveitis *q.v.*

Infiltration by neoplastic cells

Lipaemic aqueous

Masses

Foreign body*

Iris cysts

Luxated lens

Organised fibrin post inflammation*

Uveal tumours

- Adenocarcinoma
- Adenoma
- Medulloepithelioma
- Melanoma
- Metastatic

2.7 Musculoskeletal signs

2.7.1 Muscular atrophy or hypertrophy

ATROPHY

Disuse atrophy*

Orthopaedic disease* *q.v.*

Restricted exercise*

Metabolic/endocrine/systemic disease

Cachexia*

- Cardiac disease*
- Neoplasia*

Glycogen storage diseases

Hyperadrenocorticism

Hyperthyroidism* (C)

Hypothyroid myopathy (D)

Lipid storage myopathy

Mitochondrial myopathy

Poor nutritional states

- Gastrointestinal disease *q.v.*
- Inadequate protein-calorie intake

Myopathies

Degenerative/inherited

Distal myopathy of Rottweilers (D)

Fibrotic myopathy

Labrador Retriever myopathy (D)

Merosin-deficient myopathy

Muscular dystrophy

Nemaline myopathy

Inflammatory/infectious

Bacterial

Dermatomyositis

Extra-ocular myositis

Leptospirosis

Masticatory myositis

Polymyositis

Protozoal

- Neosporosis (D)

- Toxoplasmosis

Tetanus

Neurogenic

Neoplasia, e.g.

- Malignant nerve sheath tumour

Peripheral neuropathies *q.v.*

Spinal cord disease *q.v.*

HYPERTROPHY/MUSCULAR SWELLING

- Athletic training*
- Breed related*
- Myositis ossificans
- Myotonia (D)
- Muscular dystrophy
- Traumatic ischaemic neuromyopathy associated with bottom-hung pivot windows and garage doors (C)

2.7.2 Trismus ('lockjaw')

Drugs/toxins, e.g.

Cocaine

Inflammatory

- Dermatomyositis
- Granulomatous meningoencephalomyelitis
- Infectious
 - Neosporosis
 - Tetanus
 - Toxoplasmosis
- Masticatory myositis
- Trigeminal neuritis

Mechanical

- Foreign body
- Malicious, e.g. placement of rubber band
- Neoplasia
 - Mandibular
 - Maxillary
 - Oral
 - Orbital
 - Retrobulbar

Pain on opening jaw

- Foreign body*
- Myositis
- Retrobulbar cellulitis or abscess*
- Temporomandibular joint arthritis*

Tooth root abscess*

Trauma to buccal cavity or temporomandibular joint*

Temporomandibular joint ankylosis

Infection

Systemic arthropathies

Trauma*

Tumours

2.7.3 Weakness (see Section 1.1.8 for full listings)

Cardiovascular disease*

Endocrine disease*

Haematological disease*

Immune-mediated disease

Infectious disease*

Metabolic disease

Neuromuscular disease

Nutritional disorders

Physiological

Respiratory disease

Systemic disorders*

Drugs/toxins

2.8 Urogenital physical signs

2.8.1 Kidneys abnormal on palpation

Enlarged kidneys

Irregular surface

Feline infectious peritonitis (C)

Infarcts

Neoplasia*

Pericapsular abscess

Pericapsular haematoma

Polycystic kidney disease

Renal cyst

Smooth surface

- Acute kidney injury *q.v.*
- Amyloidosis
- Compensatory hypertrophy
- Hydronephrosis
- Neoplasia*
- Perinephric pseudocyst
- Polycystic kidney disease
- Pyelonephritis
- Pyogranulomatous nephritis
- Renal cyst

Normal-sized kidneys – irregular surface

- Infarcts
- Neoplasia*
- Pericapsular haematoma
- Polycystic kidney disease
- Renal cyst
- Subcapsular haematoma

Small kidneys***Irregular surface***

- Chronic generalised glomerulo- or tubulo-interstitial disease* *q.v.*
- Hypoplastic kidneys
- Multiple infarcts

Smooth surface

- Hypoplasia

Absent kidneys

- Aplasia
- Nephrectomy

2.8.2 Bladder abnormalities**#### Palpable mass**

- Neoplasia*
- Urolith*

Large bladder, difficult to express

Functional obstruction

Drugs/toxins, e.g.

- Atropine
- Glycopyrronium bromide
- Propantheline bromide
- Tricyclic antidepressants

Neurological disease

- Upper motor neurone bladder*
- Spinal disorders cranial to L7 *q.v.*

Psychogenic*

- Pain
- Stress

Reflex dyssynergia

Mechanical obstruction

Matrix-crystalline plugs*

Neoplasia*

- Bladder
- Urethra

Prostatomegaly*

Urethral stricture

Uroliths*

- Bladder neck
- Urethra

Large bladder, easy to express

Normal

Neurological disease, e.g.

Dysautonomia

Lower motor neurone bladder*

- Cauda equina syndrome
- Lesion of sacral spinal cord
- Lesions of pelvic/lumbosacral plexus

Small/difficult to palpate bladder

Congenital hypoplasia

Ectopic ureters

Non-distensible bladder

- Diffuse bladder-wall neoplasia
- Severe cystitis, e.g.
 - Calculi
 - Infection
 - Trauma

Oliguric/anuric kidney injury *q.v.*

Recent voiding*

Ruptured bladder

Ruptured ureters

2.8.3 Prostate abnormal on palpation

Enlargement

Diffuse

Bacterial prostatitis

Benign prostatic hyperplasia*

Neoplasia

Focal lesions

Abscess

Cysts

- Paraprostatic
- Prostatic

Neoplasia

2.8.4 Uterus abnormal on palpation

Enlargement on palpation

Haemometra

Hydrometra

Mucometra

Neoplasia*

- Adenocarcinoma
- Adenoma
- Leiomyoma
- Leiomyosarcoma

Post partum*

Pregnancy*

Pyometra*

2.8.5 Testicular abnormalities

Single palpable testis

- Castration of single descended testis with subsequent descent of unilateral cryptorchid testis
- Unilateral cryptorchid*
- Unilateral testicular agenesis

No palpable testis

- Bilateral cryptorchid*
- Bilateral testicular agenesis
- Intersex abnormalities
- Previous castration*

Large testis

- Acute infection
- Inguinoscrotal hernia
- Neoplasia
- Sperm granuloma
- Testicular torsion

Small testis

- Chronic inflammation
- Cryptorchidism
- Degeneration
- Hypoplasia
- Intersex
- Sertoli cell tumour in contralateral testis

2.8.6 Penis abnormalities

Paraphimosis

- Chronic balanoposthitis
- Foreign bodies in prepuce
- Fracture of the os penis
- Idiopathic
- Obstruction of the preputial opening by long hair*

Small preputial opening

- Congenital
- Post-surgical
- Traumatic

Soft tissue trauma*

Spinal lesions

Penile bleeding

Haematuria* *q.v.*

Herpes virus

Transmissible venereal tumour

Other tumours (benign polypoid to variety malignant)

Trauma

Prostatic disease, e.g.

Benign hyperplasia

Urethral disease, e.g.

Urethral prolapse

PART 3

RADIOGRAPHIC AND ULTRASONOGRAPHIC SIGNS

3.1 Thoracic radiography

3.1.1 Artefactual causes of increased lung opacity

- Chemical stains/dirty cassettes
- Dirty or wet fur
- Forelimbs not pulled sufficiently forwards
- Movement blur
- Obesity
- Poorly inflated lungs
 - Abdominal distension
 - Expiratory film
 - Upper airway obstruction
- Underdevelopment
- Underexposure

3.1.2 Increased bronchial pattern

Normal variation*

- Chondrodystrophic breeds
- Older dogs

Bronchial wall oedema, e.g.

Congestive heart failure*

Bronchiectasis**Chronic bronchitis***

Primary ciliary dyskinesia (D)

Endocrine

Hyperadrenocorticism

Infection

Bacterial*

Fungal, e.g.

- *Pneumocystis carinii*

Parasitic, e.g.

- *Crenosoma vulpis* (D)

Protozoal, e.g.

- Toxoplasmosis

Viral

Inflammation, e.g.

Eosinophilic bronchopneumopathy (pulmonary infiltrate with eosinophilia) (D)

Feline asthma (C)

Idiopathic

Neoplasia

Bronchogenic carcinoma

Lymphoma

3.1.3 Increased alveolar pattern**Atelectasis**

Airway obstruction

Chronic pleural or pulmonary disease*

Collapse of the lung lobes under general anaesthesia*

Extra-pulmonary thoracic mass

Feline asthma* (C)

Lack of surfactant (newborn, acute respiratory distress syndrome)

Lung lobe torsion
Pleural effusion* *q.v.*
Pneumothorax* *q.v.*
Recumbency

Inflammation/immune mediated

Eosinophilic bronchopneumopathy (pulmonary infiltrate with eosinophilia)

Neoplasia

Malignant histiocytosis
Primary lung tumour, e.g.

- Bronchoalveolar carcinoma

Pulmonary lymphomatoid granulomatosis

Pneumonia

Aspiration pneumonia
Aspirated foreign body*
Aspirated secretions
Cleft palate
Gastrobronchial fistula
Generalised weakness
Iatrogenic, e.g.

- Anaesthetic complication
- Force feeding
- Incorrectly placed stomach tube

Oesophagotracheal/bronchial fistula
Regurgitation, e.g.

- Megaoesophagus

Swallowing disorders
Vomiting

Bronchopneumonia, e.g.
Canine distemper virus with secondary bacterial infection* (D)
Tracheobronchitis*

Bacterial, e.g.
Tuberculosis
Tularaemia

Fungal, e.g.

Pneumocystis carinii

Parasitic, e.g.

Aelurostrongylus abstrusus (C)

Angiostrongylus vasorum (D)

Dirofilaria immitis

Oslerus osleri (D)

Miscellaneous

Kartagener's syndrome

Primary ciliary dyskinesia

Radiation therapy

Pulmonary haemorrhage

Coagulopathy *q.v.*

Exercise induced

Idiopathic

Neoplasia*

Trauma*

Pulmonary oedema

Acute dyspnoea in Swedish hunting dogs

Acute pancreatitis*

Airway obstruction

Brain trauma

Congestive heart failure*

Electrocution

Hypoalbuminaemia

Hypostatic congestion*

Iatrogenic

- Aspirated hypertonic contrast media

- IV contrast media

- Over-hydration

Inhalation of irritant gases/smoke

Lung lobe torsion

Near drowning

Obstruction of pulmonary drainage mechanisms, e.g.

- Hilar mass

Post-ictal

Re-expansion, e.g.
• Post pneumothorax
Seizures
Other CNS disease
Uraemia *q.v.*

Acute respiratory distress syndrome

Iatrogenic, e.g.
• Over-hydration
• Oxygen therapy
Infection
Inhalation pneumonia
Pancreatitis
Trauma

Toxins

Alpha-naphthylthiourea
Endotoxin
Ethylene glycol
Paracetamol
Snake venom

Pulmonary thromboembolism

3.1.4 Increased interstitial pattern

Nodular

Artefact

End-on view of blood vessels
Nipples
Objects adhering to coat
Ossification of costochondral junctions
Thoracic wall nodules

Infection

Abscesses
Feline infectious peritonitis* (C)

Granulomata

- Bacterial
- Foreign body*
- Fungal

Hydatid cysts**Parasitic**

- *Aelurostrongylus abstrusus* (C)
- *Crenosoma vulpis* (D)
- *Oslerus osleri* (D)
- *Paragonimus kellicotti* (D)
- Tularaemia
- Visceral larva migrans

Pneumonia

- Fungal pneumonia
- Haematogenous bacterial pneumonia
- Mycobacterial pneumonia

Protozoal, e.g.

- Toxoplasmosis

Neoplasia

Lymphoma*

Metastatic tumours*

Primary lung tumours

****Miscellaneous****

Calcified pleural plaques*

Disseminated intravascular coagulation

Haematomata

Idiopathic mineralisation

Pulmonary osteomata

(heterotopic bone)*

****Diffuse/unstructured****

Artefact, e.g.

Expiratory film

Neoplasia

Oedema (early) *q.v.*

Drugs/toxins

Chronic glucocorticoid administration

Paraquat

Endocrine

Hyperadrenocorticism

Infection

Bacterial

Fungal, e.g.

- Blastomycosis
- Coccidioidomycosis
- Cryptococcosis
- Histoplasmosis
- *Pneumocystis carinii* (D)

Mycoplasmosis

Parasitic

- *Aelurostrongylus abstrusus* (C)
- *Angiostrongylus vasorum* (D)
- Babesiosis
- Dirofilariasis

Protozoal, e.g.

Rickettsial, e.g.

- Rocky Mountain spotted fever (D)

Toxoplasmosis

Viral, e.g.

- Canine distemper virus* (D)
- Feline infectious peritonitis* (C)

Inhalation

Dust

Irritant gases

Miscellaneous

Acute respiratory distress syndrome

Pancreatitis

Pulmonary thromboembolism

Radiation therapy

Uraemia* *q.v.*

Very old animals

Very young animals

Pulmonary fibrosis

Idiopathic

Secondary to chronic respiratory disease

Pulmonary haemorrhage

Coagulopathy *q.v.*

Exercise induced

Idiopathic

Neoplasia

Trauma

Reticular pattern

Normal ageing*

Chronic fibrosis

Fungal pneumonia

Lymphoma*

Metastatic neoplasia*

3.1.5 Increased vascular pattern

Increased size of pulmonary arteries

Aelurostrongylus abstrusus (C)

Angiostrongylus vasorum (D)

Dirofilariasis

Large left-to-right shunts, e.g.

- Atrial septal defect
- Endocardial cushion defects
- Patent ductus arteriosus
- Ventricular septal defect

Pulmonary hypertension

Pulmonary thromboembolism

Increased size of pulmonary veins

Left-sided heart failure*

Left-to-right shunts, in some cases

Increased size of pulmonary arteries and veins

Left-to-right shunts, e.g.

- Atrial septal defect
- Endocardial cushion defects
- Patent ductus arteriosus
- Ventricular septal defect

3.1.6 Decreased vascular pattern

Generalised

Pericardial disease, e.g.

- Pericardial effusion* *q.v.*
- Restrictive pericarditis

Pulmonary hypoperfusion

- Hypoadrenocorticism (D)
- Localised hypoperfusion due to pulmonary thromboembolism
- Pulmonic stenosis
- Severe dehydration*
- Shock*
- Tetralogy of Fallot

Pulmonary overinflation

Air trapping

- Chronic bronchitis* (D)
- Feline asthma* (C)
- Upper respiratory tract obstruction, e.g.
 - Foreign body*
 - Nasopharyngeal polyp* (C)

Compensatory

- Following lobectomy
- Secondary to atelectasis of another lobe
- Secondary to congenital lobar atresia/agenesis

Emphysema

Iatrogenic

- Anaesthesia

Right-to-left cardiac shunts, e.g.

- Atrial septal defect
- Reverse-shunting patent ductus arteriosus
- Tetralogy of Fallot
- Ventricular septal defect

Localised

Emphysema

Pulmonary thromboembolism

3.1.7 Cardiac diseases that may be associated with a normal cardiac silhouette

Bacterial endocarditis
Congestive heart failure overzealously treated with diuretics
Constrictive pericarditis
Functional murmurs*
Hypertrophic cardiomyopathy* (C)
Neoplasia
Small atrial septal defect
Small ventricular septal defect

3.1.8 Increased size of cardiac silhouette

Generalised cardiomegaly

Normal variation, e.g.
Greyhound*
Artifact
Bacterial endocarditis
Bradycardia* *q.v.*
Chronic anaemia* *q.v.*
Concurrent mitral and tricuspid valve deficiency
Dysplasia
Intrapericardial fat
Mediastinal fat
Myxomatous degeneration* (D)
Congenital cardiac disease, e.g.

- Peritoneopericardial diaphragmatic hernia

Enlargement of specific chamber sizes *q.v.*
Pericardial effusion* *q.v.*

Myocardial disease

Inflammatory

- Immune mediated, e.g. rheumatoid arthritis
- Infectious, e.g.
 - Bacterial
 - Fungal
 - Parvovirus
 - Protozoal

Ischaemic

- Arteriosclerosis

Noninflammatory

- Dilated cardiomyopathy*
- Hypertrophic cardiomyopathy (C)*
- Restrictive cardiomyopathy (C)

Secondary

- Acromegaly
- Amyloidosis
- End-stage mitral valve insufficiency* (D)
- Glycogen storage disease
- Hypertension* *q.v.*
- Hyperthyroidism* (C)
- Mucopolysaccharidosis
- Neoplasia
- Neuromuscular disease
- Nutrition
 - L-Carnitine deficiency
 - Taurine deficiency
- Trauma
- Drugs/toxins
 - Doxorubicin
 - Heavy metals

Volume overload**Iatrogenic****Left-sided heart failure**

- Bacterial endocarditis
- Dilated cardiomyopathy*
- Mitral valve dysplasia
- Myxomatous degeneration of the mitral valve* (D)

3.1.9 Decreased size of cardiac silhouette

Atrophic myopathies

Constrictive pericarditis

Hypoadrenocorticism (D)

Post thoracotomy

Artifact

- Deep-chested dogs
- Deep inspiration
- Heart displaced from sternum, e.g.
 - Mediastinal shift
 - Pneumothorax
- Pulmonary overinflation, e.g.
 - Emphysema
 - Hyperventilation

Decrease in muscle mass

- Chronic systemic disease
- Malnutrition
- Myopathies

Shock* q.v., e.g.

- Hypovolaemia, e.g.
 - Blood loss
 - Severe dehydration

3.1.10 Abnormalities of the ribs

Congenital disorders

- Absence of the xiphisternum
- Agenesis/hypoplasia of the 13th rib*
- Pectus excavatum
- Supernumerary ribs

New bone

- Cartilaginous exostoses
- Healed fractures
- Mineralisation of the costal cartilages*
- Neoplasia
- Non-union fractures
- Periosteal reaction to soft tissue mass

Osteolysis

- Metastatic tumours
- Osteomyelitis
- Primary tumours

- Chondrosarcoma
- Fibrosarcoma
- Haemangiosarcoma
- Multiple myeloma
- Osteoma
- Osteosarcoma

Thoracic wall trauma*

3.1.11 Abnormalities of the oesophagus

OESOPHAGEAL DILATATION

Generalised

Acquired megaoesophagus

Idiopathic

Immune-mediated neuromuscular disease

- Myasthenia gravis
- Polymyositis
- Polyradiculoneuritis
- Systemic lupus erythematosus

Metabolic/endocrine

- Hypoadrenocorticism (D)
- Hypothyroidism* (D)

Miscellaneous

- Dysautonomia
- Gastric dilatation/volvulus*
- Hypertrophic muscular dystrophy
- Oesophageal foreign body
- Reflux oesophagitis
- Thiamine deficiency

Toxic

- Botulinum toxin
- Chlorinated hydrocarbons
- Heavy metals
- Herbicides
- Organophosphates
- Snake venom
- Tetanus

Congenital megaoesophagus

- Canine giant axonal neuropathy (D)
- Glycogen storage disease
- Hereditary megaoesophagus
- Hereditary myopathy
- Vascular ring anomaly, e.g.
 - Double aortic arch
 - Normal aorta with aberrant right subclavian artery
 - Persistent right aortic arch
 - Persistent right ductus arteriosus
 - Right aortic arch with aberrant right subclavian artery

Transient megaoesophagus

- Hiatal hernia
- Respiratory infection
- Sedation/anaesthesia*

Localised

Redundant oesophagus

Acquired

- Dilatation cranial to a gastro-oesophageal intussusception
- Dilatation cranial to acquired stricture, e.g.
 - Extraluminal compression
 - Granuloma
 - Mucosal adhesion
 - Neoplasia
 - Post general anaesthesia
- Dilatation cranial to an oesophageal foreign body*
- Oesophagitis
- Scar tissue post trauma

Congenital

- Dilatation cranial to a congenital stenosis
- Dilatation cranial to oesophageal hiatal hernia
- Segmental oesophageal hypomotility
- Vascular ring anomaly, e.g.
 - Double aortic arch
 - Normal aorta with aberrant right subclavian artery

- Persistent right aortic arch
- Persistent right ductus arteriosus
- Right aortic arch with aberrant right subclavian artery
- Oesophageal diverticulum

Transient

Aerophagia*

Dyspnoea*

Swallowing*

INCREASED OESOPHAGEAL OPACITY

Bony density

Foreign body*

Megaoesophagus with collection of food

Osteosarcoma, e.g.

- Secondary to *Spirocerca lupi* (D)

Soft tissue density

Megaoesophagus with collection of food/water

Normal variation, e.g.

- Fluid in the oesophagus*
- Superimposition of the trachea*

Soft tissue mass

Intraluminal

- Food-containing oesophageal diverticulum
- Foreign body*
- Gastro-oesophageal intussusception
- Oesophageal hiatal hernia

Intramural

- Abscess
- Foreign body
- Granuloma, e.g.
 - *Spirocerca lupi* (D)
- Neoplasia
 - *Metastatic*
 - *Primary oesophageal*, e.g.
 - Leiomyoma/sarcoma

Squamous cell carcinoma

- Secondary to *Spirocercus lupi* (D)

Extraluminal

- Abscess
- Neoplasia
- Paraoesophageal hiatal hernia

3.1.12 Abnormalities of the trachea

Dorsal displacement

Artefact

- Expiration
- Rotation
- Ventroflexion

Breed variation*

Cardiomegaly*

Cranioventral mediastinal mass

Heart base tumour

Tracheobronchial lymphadenopathy*

Ventral displacement

Craniodorsal mediastinal mass

Megaoesophagus

Oesophageal foreign body*

Post-stenotic aortic dilatation

Vertebral spondylosis

Lateral displacement

Artefact

- Expiration
- Rotation
- Ventroflexion

Breed variation*

Cranial mediastinal mass

Heart base tumour

Mediastinal shift *q.v.*

Megaoesophagus

Vascular ring anomaly

Narrowing

Congenital hypoplasia

Artifact

Hyperextension of the neck
Superimposition of the
muscle/oesophagus

External compression

Cranial mediastinal mass
Megaoesophagus
Oesophageal foreign body*
Vascular ring anomaly

Mucosal thickening

Feline infectious peritonitis* (C)
Inflammation, e.g.

- Allergy*
- Infection*
- Irritant gases

Submucosal haemorrhage, e.g.
• Coagulopathy

Stricture/stenosis

Congenital
Excessive pressure from the cuff
of endotracheal tube
Focal intramural mass
Post-traumatic injury

Tracheal collapse*

Acquired, e.g.
• Secondary to chronic bronchitis
Congenital

Opacification of the lumen

Abscess
Aspiration of positive contrast agents
Foreign body*
Granuloma
Oslerus osleri
Polyp

Neoplasia

Adenocarcinoma
Chondrosarcoma
Leiomyoma
Lymphoma
Mast cell tumour
Osteochondroma
Osteosarcoma

3.1.13 Pleural effusion

Bile pleuritis

Ruptured biliary tree with diaphragmatic hernia

Blood

Autoimmune disorders, e.g.
• Immune-mediated thrombocytopenia
Angiostrongylus vasorum infection
Coagulopathy
Neoplasia, e.g.
• Haemangiosarcoma
Trauma

Chyle

Congenital duct malformation (D)
Constrictive pleuritis
Cranial mediastinal mass
Diaphragmatic rupture*
Feline dirofilariasis (C)
Idiopathic*
Lung lobe torsion
Neoplasia
Peritoneopericardial diaphragmatic hernia
Post pacemaker implantation (C)
Rupture of the thoracic duct

Heart disease*

Dilated cardiomyopathy (C)
Hypertrophic cardiomyopathy (C)*

Pericardial disease
Right-sided heart failure (C)

Obstruction of the thoracic duct

Intraluminal

- Granuloma
- Neoplasia

Extraluminal

- Increased intrathoracic pressure

Exudate

Actinomycosis

Autoimmune disorders, e.g.

- Rheumatoid arthritis
- Systemic lupus erythematosus

Feline infectious peritonitis* (C)

Fungal infection

Neoplasia*

Nocardiosis

Pneumonia*

Pyothorax*

- Extension from pulmonary parenchymal lesion

Foreign body

- Haematogenous spread
- Penetrating thoracic wound
- Penetration of the trachea/oesophagus

Tuberculosis

Transudate/modified transudate

Congestive heart failure*

Diaphragmatic rupture*

Foreign body

Hyperthyroidism* (C)

Hypoproteinaemia *q.v.**

- Liver disease*
- Protein-losing enteropathy*
- Protein-losing nephropathy*

Idiopathic

Lung lobe torsion

Neoplasia, e.g.

- Lymphoma*

Pancreatitis

Pneumonia*

Thromboembolism

3.1.14 Pneumothorax

Artifact

Overdevelopment

Overexposure*

Overinflation of the lungs

Skin folds*

Undercirculation

Iatrogenic

Cardiopulmonary resuscitation

Leaking chest drain

Lung aspiration/biopsy

Thoracocentesis

Thoracotomy

Spontaneous

Bacterial pneumonia

Parasites

- Dirofilariasis
- *Oslerus osleri*
- *Paragonimus*

Pleural adhesions

Rupture of congenital or acquired bullae,
cysts or blebs

Tumours*

Trauma

Perforation of the lung*

Perforation of the oesophagus

Perforation of the thoracic wall*

Perforation of the trachea/bronchi*

3.1.15 Abnormalities of the diaphragm

Cranial displacement

Diaphragmatic rupture/hernia*

Abdominal causes

Abdominal neoplasia*

Ascites*

Gastric dilatation*

Obesity*

Organomegaly*, e.g.

- Liver

- Spleen

Pneumoperitoneum

Pregnancy*

Pyometra*

Thoracic causes

Atelectasis

Diaphragmatic paralysis

Diaphragmatic tumour

Expiratory film*

Lung lobectomy

Pleural adhesions

Pulmonary fibrosis

Caudal displacement

Abdominal causes

Abdominal body wall rupture/hernia leading to abdominal organ displacement

Poor body condition

Thoracic causes

Chronic dyspnoea*

Deep inspiration*

Intrathoracic mass*

Pleural effusion*

Pneumothorax*

Irregular diaphragmatic contour

Diaphragmatic rupture/hernia*

Hypertrophic muscular dystrophy

Pleural masses, e.g.

- Granuloma
- Neoplasia

Severe lung hyperinflation

Lack of visualisation of diaphragmatic border

Artefact, e.g.

- Expiratory film

Diaphragmatic hernia*

Increased lung density, e.g.

- Alveolar pattern*

Neoplasia adjacent to diaphragm*

Peritoneopericardial diaphragmatic hernia

Pleural effusion*

3.1.16 Mediastinal abnormalities

Mediastinal masses

Aortic aneurysm

Cyst

Granuloma

- Actinomycosis
- Nocardiosis

Haematoma

Hiatal hernia

Oesophageal dilatation

Oesophageal foreign body*

Oesophageal granuloma

- *Spirocercus lupi* (D)

Thymus

Artefact

Left or right atrial enlargement

Lung lobe tip

Pleural fluid

Post-stenotic dilatation of the aorta or pulmonary artery

Lymphadenopathy

Bacterial

- Actinomycosis
- Nocardiosis
- Tuberculosis

Eosinophilic pulmonary granulomatosis

Fungal

- Blastomycosis
- Coccidioidomycosis
- Cryptococcosis
- Histoplasmosis

Neoplasia

- Lymphoma*
- Malignant histiocytosis
- Metastatic neoplasia*

Neoplasia

Ectopic parathyroid tumour

Ectopic thyroid tumour

Fibrosarcoma

Heart base tumours

Lipoma*

Lymphoma*

Malignant histiocytosis

Rib tumour

Thymoma

Mediastinal shift

Away from affected hemithorax

Diaphragmatic rupture/hernia*

Lobar emphysema

Lung mass*

Oblique view

Pleural mass*

Unilateral pleural effusion*

Unilateral pneumothorax*

Towards affected hemithorax

Atelectasis

- Feline asthma* (C)
- Foreign body*
- Mass*
- Radiation

Hypostatic congestion*, e.g.

- General anaesthesia
- Illness resulting in prolonged lateral recumbency

Lobar agenesis/hypoplasia

Lobectomy

Lung lobe torsion

Oblique view

Radiation-induced fibrosis

Unilateral phrenic nerve paralysis

Pneumomediastinum

Emphysematous mediastinitis

Iatrogenic

Secondary to severe dyspnoea*

Air from neck

Gas-forming bacteria

Trauma*, e.g.

- Jugular venepuncture
- Oesophagus
- Pharynx
- Soft tissue
- Trachea

Air from bronchi/lungs, e.g.

Lung lobe torsion

Spontaneous

Trauma*

Widened mediastinum

Normal variation*

- Bulldogs

Abscess

- Foreign body

Masses (see succeeding text)

Megaoesophagus *q.v.*

Obesity*

Mediastinal effusions, e.g.

Chylomediastinum

Haemorrhage

- Coagulopathy
- Neoplasia
- Trauma*

Mediastinitis/mediastinal abscess

Feline infectious peritonitis (C)

Lymphadenitis

Oesophageal/tracheal perforation

Penetrating neck wound*

Pleuritis*

Pneumonia*

*Oedema**

Congestive heart failure*

Hypoproteinaemia* *q.v.*

Neoplasia*

Trauma*

3.2 Abdominal radiography

3.2.1 Liver

Focal enlargement

Infection/inflammation

Abscess

Granuloma

Miscellaneous

Biliary pseudocyst

Cyst

Haematoma
Hepatic arteriovenous fistula
Hyperplastic/regenerative nodule*
Liver lobe torsion

Neoplasia*

Biliary cystadenoma
Haemangiosarcoma
Hepatocellular carcinoma*
Hepatoma
Lymphoma*
Malignant histiocytosis
Metastatic*

Generalised enlargement

Endocrine disease

Acromegaly
Diabetes mellitus*
Hyperadrenocorticism

Infection/inflammation

Abscess
Feline infectious peritonitis* (C)
Fungal infection
Granuloma
Hepatitis*
Lymphocytic cholangitis*

Neoplasia, e.g.

Haemangiosarcoma
Lymphoma*
Malignant histiocytosis
Mast cell infiltration (mastocytosis/mast cell tumour)
Metastatic tumours*

Venous congestion

Caudal vena cava occlusion (post caval syndrome)

- Adhesions
- Cardiac neoplasia
- Congenital cardiac disease

- Diaphragmatic rupture/hernia*
- Dirofilariasis
- Pericardial disease
- Thoracic mass
- Thrombosis
- Trauma*

Right-sided congestive heart failure, e.g.

- Dilated cardiomyopathy*
- Pericardial disease, e.g. pericardial effusion *q.v.*
- Tricuspid regurgitation

Miscellaneous

Amyloidosis

Cholestasis *q.v.**

Cirrhosis (early)*

Hepatic lipidosis (C)

Nodular hyperplasia*

Storage diseases

Drugs

Glucocorticoids

Reduced liver size

Breed variation (e.g. apparent microhepatia in deep-chested dogs)

Cirrhosis

Diaphragmatic rupture/hernia*

Hypoadrenocorticism (D)

Idiopathic hepatic fibrosis

Portosystemic shunt

- Acquired
- Congenital

3.2.2 Spleen

Enlargement

Normal, e.g.

Breed related*

Congestion

- Gastric dilatation/volvulus*
- Portal hypertension
- Right-sided congestive heart failure
- Sedation and general anaesthesia*
- Splenic thrombosis
- Splenic torsion

*Haematoma**

- Idiopathic
- Secondary to neoplasia
- Trauma

*Hyperplasia**

- Chronic anaemia *q.v.*
- Chronic infection
- Lymphoid

Inflammation/immune mediated

- Hypereosinophilic syndrome
- Immune-mediated haemolytic anaemia
- Systemic lupus erythematosus

Infection

- Abscess
- Babesiosis
- Bacteraemia
- Ehrlichiosis
- Feline infectious peritonitis* (C)
- Fungal infections
- Infectious canine hepatitis (D)
- Leishmaniasis
- Mycobacteria*
- Mycoplasma*
- Toxoplasmosis
- Salmonellosis
- Septicaemia*

Neoplasia

- Fibrosarcoma
- Haemangioma

Haemangiosarcoma*
Leiomyosarcoma
Leukaemia
Lymphoma*
Malignant histiocytosis
Multiple myeloma
Systemic mastocytosis

Miscellaneous

Amyloidosis
Extramedullary haematopoiesis*
Infarction
Splenic myeloid metaplasia

Trauma

Foreign body
Penetrating wound

Reduction in size

Dehydration*
Shock* *q.v.*

Absence

Artefact
Displacement through hernia/rupture
Splenectomy

3.2.3 Stomach

Abnormal contents

Gas
Aerophagia*
Gastric dilatation/volvulus*

Mineral opacity
Foreign body*
Gravel sign (outflow obstruction)*

Iatrogenic

- Barium
- Bismuth
- Kaolin

Soft tissue opacity

Blood clot

Food/ingested liquid*

Foreign body*

Intussusception

Neoplasia

Polyp

Caudal displacement

Enlargement of the thoracic cavity, e.g.

- Overinflation of the lungs
- Pleural effusion* *q.v.*

Hepatomegaly* *q.v.*

Cranial displacement

Diaphragmatic hernia/rupture*

Hiatal hernia

Late pregnancy*

Microhepatica

Neoplasia/mass, e.g.

- Colonic
- Mesenteric
- Pancreatic

Peritoneopericardial
diaphragmatic hernia

Delayed gastric emptying

Gastritis*

General anaesthesia/sedation*

Functional disorders

Adynamic ileus*

Dysautonomia

Pancreatitis*

Primary dysmotilities

Uraemia* *q.v.*

Pyloric outflow obstruction

Chronic hyperplastic gastropathy

Fibrosis/scar tissue

Foreign body*

Granuloma

Neoplasia

- Biliary
- Duodenal
- Gastric
- Pancreatic

Pyloric hypertrophy

- Mucosal
- Muscular

Ulceration

Pylorospasm

Anxiety

Stress

Ulceration

Duodenal

Gastric

Distended

Acute gastritis*

Gastric dilatation volvulus*

Pancreatitis*

*Aerophagia**

Bolting food

Dyspnoea

Pain

Iatrogenic

Anticholinergic drugs

Endoscopic inflation

Misplaced endotracheal tube

Stomach tube

Outflow obstruction

Fibrosis/scarring

Foreign body*

Granuloma
Muscular or mucosal hypertrophy
Neoplasia
Pylorospasm
Ulceration

Increased wall thickness (contrast radiography)

Diffuse

Inflammation

- Chronic gastritis*
- Eosinophilic gastritis*

Neoplasia

- Lymphoma
- Pancreatic tumour

Chronic hyperplastic gastropathy

Focal

Artefact

- Empty stomach

Hypertrophy

- Mucosal
- Muscular

Inflammation

- Eosinophilic
- Fungal infection
- Granulomatous

Neoplasia

- Adenocarcinoma
- Leiomyoma
- Leiomyosarcoma
- Lymphoma

3.2.4 Intestines

SMALL INTESTINE

Bunching

Adhesions*
Linear foreign body*
Obesity*

Displacement

Caudal displacement

- Distended stomach*
- Empty urinary bladder*
- Hepatomegaly* *q.v.*
- Hernias*
 - Inguinal*
 - Perineal*

Cranial displacement

- Empty stomach*
- Enlarged urinary bladder* *q.v.*
- Enlarged uterus*
 - Pregnancy*
 - Pyometra*
- Microhepatica

Diaphragmatic disorders

- Peritoneopericardial diaphragmatic hernia
- Rupture/hernia*

Lateral displacement

- Hepatomegaly* *q.v.*
- Prolonged lateral recumbency*
- Renomegaly* *q.v.*
- Splenomegaly* *q.v.*

Increased width of small intestinal loops

Artefact

- Mistaking colon for small intestine

Functional obstruction

- Dysautonomia
- Electrolyte imbalances* *q.v.*
- Pancreatitis*
- Peritonitis*
- Recent abdominal surgery*
- Secondary to chronic mechanical obstruction*
- Severe gastroenteritis*

Mechanical obstruction

- Abscess
- Adhesions*
- Caecal impaction
- Constipation*
- Foreign body*
- Granuloma
- Intestinal volvulus
- Intussusception
- Neoplasia, e.g.
 - Adenocarcinoma
 - Leiomyoma
 - Leiomyosarcoma
 - Lymphoma
- Polyps
- Strangulation in hernia/mesenteric tear
- Stricture

Variation in small intestinal contents*Bony/mineral density*

- Food*
- Foreign body*
- Iatrogenic
 - Contrast media
 - Medications

Fluid/soft tissue density

- Normal*
- Diffuse infiltrative neoplasia
- Functional obstruction
 - Dysautonomia
 - Electrolyte imbalances* *q.v.*
 - Pancreatitis*
 - Peritonitis*
 - Recent abdominal surgery*
 - Secondary to chronic mechanical obstruction*
 - Severe gastroenteritis*

Mechanical obstruction

- Abscess
- Adhesions*

- Caecal impaction
- Constipation*
- Foreign body*
- Granuloma
- Intestinal volvulus
- Intussusception
- Neoplasia, e.g.
 - Adenocarcinoma
 - Leiomyoma
 - Leiomyosarcoma
 - Lymphoma
- Polyps
- Strangulation in hernia/mesenteric tear

Mistaking colon or enlarged uterus for small intestine

Gas density

Normal*

Adhesions*

Aerophagia*

Enteritis*

Functional obstruction

- Dysautonomia
- Electrolyte imbalances* *q.v.*
- Pancreatitis*
- Peritonitis*
- Recent abdominal surgery*
- Secondary to chronic mechanical obstruction*
- Severe gastroenteritis*

Mechanical obstruction

- Abscess
- Adhesions
- Caecal impaction
- Constipation*
- Foreign body*
- Granuloma
- Intestinal volvulus
- Intussusception
- Neoplasia, e.g.
 - Adenocarcinoma
 - Leiomyoma

- Leiomyosarcoma
 - Lymphoma
 - Polyps
 - Strangulation in hernia/mesenteric tear
- Partial obstruction*
- Prolonged recumbency*

Delayed intestinal transit time

- Diffuse neoplasia
- Enteritis*
- Inflammatory bowel disease*
- Sedation/general anaesthesia*

Functional obstruction

- Dysautonomia
- Electrolyte imbalances* *q.v.*
- Pancreatitis*
- Peritonitis*
- Recent abdominal surgery*
- Secondary to chronic mechanical obstruction*
- Severe gastroenteritis*

Mechanical obstruction (partial)

- Abscess
- Adhesions*
- Caecal impaction
- Constipation*
- Foreign body*
- Granuloma
- Intussusception
- Neoplasia, e.g.
 - Adenocarcinoma
 - Leiomyoma
 - Leiomyosarcoma
 - Lymphoma
- Polyps
- Strangulation in hernia/mesenteric tear

Luminal filling defects on contrast radiography

- Foreign body*
- Intussusception

Neoplasia
Parasitism*
Polyp
Ulcer

Increased wall thickness (contrast radiography)

Inflammatory bowel disease*
Fungal infections
Lymphangiectasia
Neoplasia, e.g.

- Adenocarcinoma
- Leiomyoma
- Leiomyosarcoma
- Lymphoma

LARGE INTESTINE

Dilatation

Constipation/obstipation* *q.v.*

Displacement

Ascending colon

Adrenal mass
Duodenal dilatation*
Hepatomegaly* *q.v.*
Lymphadenopathy* *q.v.*
Pancreatic mass
Renomegaly *q.v.*

Transverse colon

Diaphragmatic rupture/hernia*
Dilatation of the stomach*
Enlarged bladder* *q.v.*
Enlarged uterus*
Hepatomegaly* *q.v.*
Lymphadenopathy* *q.v.*
Microhepatica *q.v.*
Mid-abdominal mass*
Pancreatic mass

Descending colon

Adrenal mass
Enlarged bladder* *q.v.*
Enlarged uterus* *q.v.*
Hepatomegaly* *q.v.*
Lymphadenopathy* *q.v.*
Prostatomegaly*
Renomegaly* *q.v.*
Retroperitoneal fluid
Splenomegaly* *q.v.*

Rectum

Paraprostatic cyst
Perineal hernia*
Prostatomegaly*
Sacral or vertebral mass
Urethral mass
Vaginal mass
Other pelvic/intrapelvic mass

Variation in contents*Empty*

Normal
Caecal inversion
Enema
Gastric/small intestinal obstruction* *q.v.*
Large intestinal diarrhoea* *q.v.*
Intussusception
Neoplasia
Typhlitis

Soft tissue/mineral density

Caecal impaction
Constipation/obstipation* *q.v.*
Undigested dietary material*

Increased wall thickness (contrast radiography)

Colitis*
Fibrosis from previous trauma/surgery
Neoplasia

Luminal filling defects on contrast radiography

Caecal inversion

Faeces*

Foreign body*

Intussusception

Masses

- Neoplasia
- Polyps

3.2.5 Ureters

Dilated

Ascending infection

Ectopic ureter

- Congenital
- Ureteral obstruction, e.g. ligation

External compression, e.g.

- Abdominal mass*

Hydrourerter

- Iatrogenic
- Neoplasia
- Stricture following ureterolith or other trauma
- Ureterolith

Ureteral diverticula

Ureterocoele

3.2.6 Bladder

Abnormal bladder contents (contrast cystography)

Filling defects

Artefact

Air bubbles*

Blood clots*

Calculi*

Neoplasia

Polyps

Severe cystitis*

Increased opacity

Blood clots*
Neoplasia
Polyps
Uroliths*

Abnormal shape

Diverticula
Herniation
Neoplasia
Patent urachus
Positioning errors
Rupture

Displacement

Abdominal hernia/rupture*
Constipation/obstipation* *q.v.*
Enlarged uterus* *q.v.*
Lymphadenopathy* *q.v.*
Obesity*
Perineal hernia*
Prepubic tendon rupture
Prostatomegaly*
Short urethra
Traumatic urethral injury

Failure of the bladder to distend (contrast radiography)

Congenital defects, e.g.
Ectopic ureters
Hypoplasia
Cystitis*
Neoplasia
Rupture

Enlarged bladder

Normal*

Functional obstruction

Neurological

- Cauda equina syndrome
- Dysautonomia

- Upper motor neurone spinal cord lesion *q.v.*, e.g.
 - Intervertebral disc disease* (D)
 - Trauma
 - Tumour

Psychogenic*

- Lack of outside/litter access
- Pain
- Stress

Mechanical obstruction

Crystalline-matrix plugs*

Neoplasia

- Bladder
- Urethra

Prostatomegaly*

Urethral stricture

Uroliths*

- Bladder neck
- Urethra

Small bladder

Anuria

Congenital hypoplasia

Ectopic ureters

Feline lower urinary tract disease

Non-distensible bladder

- Diffuse bladder wall neoplasia
 - Severe cystitis, e.g.
 - Calculi*
 - Infection*
 - Trauma*

Recent voiding*

Ruptured bladder

Ruptured ureters

Decreased opacity

Emphysematous cystitis

Iatrogenic

Increased opacity

Chronic cystitis*

Foreign body

Neoplasia

Radiopaque calculi*

- Oxalate

- Silica

- Struvite

Superimposition of other organs

Thickening of the bladder wall (contrast cystography)

Chronic cystitis*

Chronic outflow obstruction

Polyps

Small bladder*

Neoplasia

Adenocarcinoma

Leiomyoma

Leiomyosarcoma

Metastatic neoplasia

Rhabdomyosarcoma

Squamous cell carcinoma

Transitional cell carcinoma

Non-visualisation

Ascites

Bladder hypoplasia

Bladder rupture

Empty bladder

- Bilateral ectopic ureters

- Cystitis*

- Post voiding*

Lack of abdominal fat

Positioning fault

3.2.7 Urethra

Contrast medium leakage

Hypospadias

Normal

Previous urethrotomy/urethrostomy

Prostatic disease*

Urethral rupture

- Iatrogenic
- Trauma

Displacement

Adjacent neoplasia

Bladder displacement

Prostatic disease*

Filling defects (contrast urethrography)

Air bubbles*

Blood clots

Neoplasia

Uroliths*

Strictures/irregular surface

Neoplasia

Previous surgery

Previous uroliths

Prostatic disease*

Urethritis*

3.2.8 Kidneys

Dilatation of the renal pelvis (contrast radiography)

Chronic pyelonephritis

Diuresis

Ectopic ureter

Nephrolithiasis or ureterolithiasis

Renal neoplasia

Hydronephrosis

Extrinsic mass

Neoplasia

- Bladder
- Prostate
- Trigone

Paraureteral pseudocyst

Ureteral blood clot

Ureteral inflammation

Ureteral stricture

Ureterolith

Renal pelvic blood clot

Coagulopathy

Iatrogenic (post biopsy)

Idiopathic renal haemorrhage

Neoplasia

Trauma

Enlargement

Irregular outline

Abscess

Cyst

Granuloma

Haematoma

Infarction

Neoplasia

- Adenoma
- Anaplastic sarcoma
- Cystadenocarcinoma
- Haemangioma/haemangiosarcoma
- Metastatic neoplasia
- Nephroblastoma
- Papilloma
- Renal cell carcinoma
- Transitional cell carcinoma

Polycystic kidney disease

Smooth outline

Acute pyelonephritis

Acute kidney injury *q.v.*

Amyloidosis

Compensatory renal hypertrophy

Congenital conditions

- Ectopic ureter
- Ureterocele

Feline infectious peritonitis* (C)

Hydronephrosis

- Extrinsic mass

- Neoplasia, e.g.
 - Bladder
 - Prostate
 - Trigone
- Paraureteral pseudocyst
- Ureteral blood clot
- Ureteral inflammation
- Ureterolith
- Ureteral stricture

Neoplasia, e.g.

- Lymphoma*

Nephritis*

Perirenal pseudocysts

Portosystemic shunts

Subcapsular abscess

Subcapsular haematoma

Increased radiopacity

Nephroliths

Artefact

Superimposition

Dystrophic mineralisation

Abscess

Granuloma

Haematoma

Neoplasia

Osseous metaplasia

Nephrocalcinosis

Chronic kidney disease* *q.v.*

Ethylene glycol toxicity

Hyperadrenocorticism

Hypercalcaemia *q.v.*

Nephrotoxic drugs

Renal telangiectasia

Non-visualisation

Artefact/technical factors

Nephrectomy

Obscured by gastrointestinal tract contents*

Reduced intra-abdominal contrast* *q.v.*

Retroperitoneal effusion

- Haemorrhage

- Urine

Unilateral renal agenesis

Very small kidneys

Small kidneys

Chronic glomerulonephritis

Chronic interstitial nephritis*

Chronic pyelonephritis

3.2.9 Loss of intra-abdominal contrast

Artifact

Ultrasound gel on coat*

Wet hair coat*

Ascites/peritoneal fluid

Bile

Ruptured biliary tract

- Cholelithiasis
- Neoplasia
- Post surgery, e.g.
 - Cholecystectomy
- Severe cholecystitis
- Trauma

Blood

Angiostrongylus vasorum

Coagulopathy *q.v.*

Neoplasia*, e.g.

- Haemangiosarcoma

Trauma

Chyle

Lymphangiectasia

Ruptured cisterna chyli

- Neoplasia
- Trauma

Exudate

Feline infectious peritonitis* (C)

Septic peritonitis, e.g.

- Iatrogenic/nosocomial
- Neoplasia*
- Pancreatitis*
- Penetrating wound
- Ruptured viscus
 - Neoplasia*
 - Post surgery, e.g.
 - Enterotomy wound dehiscence*
 - Trauma*

Transudate/modified transudate, e.g.

Cardiac tamponade

Caudal vena caval obstruction

Hepatic disease

- Cholangiohepatitis*
- Chronic hepatitis*
- Cirrhosis*
- Fibrosis*

Hypoalbuminaemia* *q.v.*

Neoplasia

Portal hypertension

Right-sided heart failure*

Urine

Lower urinary tract rupture

- Bladder
- Ureter
- Urethra

Diffuse peritoneal neoplasia

Lack of abdominal fat

Emaciation*

Immaturity*

Peritonitis

Irritant

Bile
Urine

Miscellaneous

Neoplasia
Pancreatitis*

Septic

Bile leakage
Gastrointestinal tract leakage

- Devitalisation
 - Foreign body*
 - Gastric dilatation/volvulus*
 - Intestinal volvulus
 - Intussusception
- Perforation
 - Enterotomy wound dehiscence*
 - Gastroduodenal ulceration
 - Penetrating wound

Hepatic abscess
Ruptured prostatic abscess
Ruptured uterus
Septicaemia*
Splenic abscesses
Urinary tract disruption

Viral

Feline infectious peritonitis* (C)

3.2.10 Prostate

Displacement

Abdominal weakness
Full bladder*
Perineal hernia*
Prostatomegaly*

Enlargement

Benign prostatic hyperplasia*
Paraprostatic cysts

Prostatic cysts
Prostatic neoplasia
Prostatitis*
Testicular neoplasia*

3.2.11 Uterus

Enlargement

Haemometra
Hydrometra
Mucometra
Neoplasia
Post partum*
Pregnancy*
Pyometra*
Torsion

3.2.12 Abdominal masses

Cranial abdomen

Adrenal mass
Hepatomegaly/hepatic mass* *q.v.*
Pancreatic mass
Stomach distension/mass*

Mid abdomen

Cryptorchidism*
Mesenteric lymphadenopathy*
Ovarian masses*
Pancreatic enlargement
Renomegaly/renal mass* *q.v.*
Small intestine

- Foreign body*
- Neoplasia*
- Obstruction*

Splenomegaly/splenic mass* *q.v.*

Caudal abdomen

Distended urinary bladder* *q.v.*

Enlarged uterus* *q.v.*

Large intestine

- Foreign body*
- Neoplasia
- Obstruction*

Lymphadenopathy

Prostatomegaly*

3.2.13 Abdominal calcification/mineral density

Abdominal fat

Idiopathic

Pansteatitis

Adrenal glands

Idiopathic

Neoplasia

Arteries

Arteriosclerosis

Gastrointestinal tract

Foreign bodies and ingesta*

Iatrogenic

- Contrast media
- Medication

Uraemic gastritis* *q.v.*

Genital tract

Chronic prostatitis*

Cryptorchidism*

Neoplasia

Ovarian neoplasia

Ovarian or prostatic cyst*

Pregnancy*

Liver

Abscess

Cholelithiasis

Chronic cholecystitis*
Chronic hepatopathy*
Cyst
Granuloma
Haematoma
Neoplasia
Nodular hyperplasia*

Lymph nodes

Inflammation*
Neoplasia*

Miscellaneous

Calcinosis cutis
Chronic hygroma
Foreign body*
Mammary gland neoplasia*
Myositis ossificans

Pancreas

Chronic pancreatitis*
Fat necrosis
Neoplasia
Pancreatic pseudocyst

Spleen

Abscess
Haematoma*
Histoplasmosis

Urinary tract

Chronic inflammation*
Neoplasia
Nephrocalcinosis

- Chronic kidney disease* *q.v.*
- Hyperadrenocorticism
- Hypercalcaemia* *q.v.*
- Nephrotoxic drugs *q.v.*

Urolithiasis*

3.3 Skeletal radiography

3.3.1 Fractures

Congenital/inherited weakness, e.g.

Incomplete ossification of the humeral condyle

Iatrogenic

Bone biopsy

Complication of orthopaedic surgery

Pathological

Bone cyst

Osteopenia *q.v.*

Neoplasia

Chondrosarcoma

Fibrosarcoma

Haemangiosarcoma

Metastatic neoplasia

Multilobular osteochondrosarcoma

Multiple myeloma

Osteosarcoma*

Osteomyelitis

Bacterial*

Fungal

Protozoal, e.g.

- Leishmaniasis

Traumatic*

3.3.2 Altered shape of the long bones

Abnormally straight

Premature closure of growth plate

Angulation

Fractures*

Bowing

- Asymmetric growth plate bridging
- Iatrogenic, e.g.
 - Plating
 - Metaphyseal osteopathy
 - Chondrodysplasia
 - Chondrodystrophy
 - May be normal breed variation*
 - Congenital hypothyroidism
 - Rickets
 - Tension
 - Quadriceps contracture
 - Shortening of the ulna

Irregular margination

- Calcifying tendinopathy
- Bone cyst
 - Enchondromatosis
- Metaphyseal osteopathy
- Neoplasia
 - Chondrosarcoma
 - Multiple cartilaginous exostoses
 - Osteosarcoma*
- Periosteal remodelling *q.v.*

3.3.3 Dwarfism

Disproportionate

- Chondrodysplasia
- Hypervitaminosis A
- Hypothyroidism
- Mucolipidosis type II
- Mucopolysaccharidoses
- Rickets

Proportionate

- Hypothyroidism
- Pituitary dwarfism

3.3.4 Delayed ossification/growth plate closure

Chondrodysplasia
Copper deficiency
Early neutering
Hypervitaminosis D
Hypothyroidism (D)
Mucopolysaccharidosis
Pituitary dwarfism

3.3.5 Increased radiopacity

Artifact
Bone infarcts
Folding fractures*
Growth arrest lines
Lead poisoning
Metaphyseal osteopathy
Neoplasia
Panosteitis
Skeletal immaturity* (metaphyseal condensation)

Osteomyelitis

Bacterial*
Fungal
Protozoal, e.g.
• Leishmaniasis

Osteopetrosis

Acquired

- Chronic excess dietary intake of calcium
- Chronic hypervitaminosis D
- Feline leukaemia virus* (C)
- Idiopathic
- Myelofibrosis

Congenital

3.3.6 Periosteal reactions

Craniomandibular osteopathy

Hip dysplasia*

Hypertrophic osteopathy

Hypervitaminosis A

Metaphyseal osteopathy

Mucopolysaccharidosis

Neoplasia

Panosteitis

Trauma*

Infection

Bacterial*

Fungal

Protozoal

- Hepatozoonosis

- Leishmaniasis

Tuberculosis

3.3.7 Bony masses

Neoplasia

Benign

Chondroma

Endochondroma

Monostotic osteochondroma

Multiple osteochondroma (C)

Osteoma

Polyostotic osteochondroma/multiple cartilaginous exostoses

Malignant

Locally invasive soft tissue

Malignant melanoma of the digit

Soft tissue sarcomas

Squamous cell carcinoma of the digit

Primary bone

- Chondrosarcoma

- Fibrosarcoma

- Giant cell tumour
- Haemangiosarcoma
- Liposarcoma
- Lymphoma
- Multiple myeloma
- Multilobular osteochondrosarcoma
- Osteosarcoma
- Parosteal osteosarcoma
- Plasma cell tumour
- Undifferentiated sarcoma

Tumours which metastasise to bone

- Mammary carcinoma
- Prostatic carcinoma
- Pulmonary carcinoma
- Sarcomas of the rib/chest wall

Miscellaneous

Craniomandibular osteopathy

Enthesopathies

Proliferative joint disease

Disseminated skeletal hyperostosis

Feline periosteal proliferative polyarthropathy (C)

Hypervitaminosis A

Osteoarthritis*

Trauma

Callus*

Hypertrophic non-union

Periosteal reaction

3.3.8 Osteopenia

Artifact

Disuse

Fracture*

Lameness*

Paralysis

Iatrogenic

Chronic anticonvulsant therapy, e.g.
Phenobarbitone
Phenytoin
Primidone
Chronic glucocorticoid administration
Stress protection from plating/casting

Metabolic/endocrine/systemic

Diabetes mellitus*
Hyperadrenocorticism
Hyperthyroidism* (C)
Lactation*
Mucopolysaccharidosis
Pregnancy*
Primary hyperparathyroidism
Renal secondary hyperparathyroidism*

Miscellaneous

Ageing changes
Osteogenesis imperfecta
Panosteitis

Neoplasia

Multiple myeloma
Pseudohyperparathyroidism (see succeeding text)

Nutrition

Chronic protein malnutrition
Hypervitaminosis A
Hyper-/hypovitaminosis D
Nutritional secondary hyperparathyroidism
Pseudohyperparathyroidism

- Adenocarcinoma of the apocrine glands of anal sacs
- Gastric squamous cell carcinoma
- Lymphoma*
- Mammary adenocarcinoma
- Multiple myeloma

- Testicular interstitial cell tumour
- Thyroid adenocarcinoma

Rickets

Toxins

Lead poisoning

3.3.9 Osteolysis

Avascular necrosis of the femoral head* (D)

Bone cysts

Feline femoral metaphyseal osteopathy (C)

Fibro-osseous dysplasia

Fibrous dysplasia

Infarct

Intraosseous epidermoid cysts

Metaphyseal osteopathy

Pressure atrophy

Retained cartilaginous core

Trauma*

Infection

Bacterial

- Bone abscess
- Iatrogenic, e.g. around surgical implants*
- Osteomyelitis*
- Sequestrum

Fungal

Protozoal

- Leishmaniasis

Neoplasia

Enchondroma

Malignant soft tissue tumour

Metastatic tumour

Multiple myeloma

Osteochondroma/multiple cartilaginous exostoses

Osteoclastoma

3.3.10 Mixed osteolytic/osteogenic lesions

Infection

Bacterial

Osteomyelitis*
Sequestrum

Fungal

Aspergillosis
Blastomycosis
Coccidioidomycosis
Cryptococcosis
Histoplasmosis

Protozoal

Leishmaniasis

Neoplasia

Chondrosarcoma
Fibrosarcoma
Haemangiosarcoma
Liposarcoma
Malignant soft tissue tumour*
Metastatic*
Osteosarcoma*

3.3.11 Joint changes

Joint space – increased size

Degenerative joint disease
Intra-articular soft tissue mass
Joint effusion*
Juvenile animal
Positioning artefact/traction
Subluxation

Epiphyseal dysplasia

Chondrodysplasia
Congenital hypothyroidism

Mucopolysaccharidosis
Pituitary dwarfism

Subchondral osteolysis

Neoplasia
Osteochondrosis
Rheumatoid arthritis
Septic arthritis*

Joint space – reduced size

Degenerative joint disease*
Erosive rheumatoid arthritis
Erosive septic arthritis
Periarticular fibrosis
Positioning artefact*

Mixed osteolytic/proliferative joint disease

Avascular necrosis of the femoral head* (D)
Feline periosteal proliferative polyarthropathy (C)
Feline tuberculosis (C)
Leishmaniasis
Neoplasia
Non-infectious erosive polyarthritis
Osteochondromatosis
Periosteal proliferative polyarthritis
Repeated haemarthroses
Rheumatoid arthritis
Septic arthritis*
Villonodular synovitis

Osteolytic joint disease

Avascular necrosis of the femoral head* (D)
Chronic haemarthrosis
Epiphyseal dysplasia causing apparent osteolysis
Incomplete ossification in juveniles
Osteochondrosis
Osteopenia *q.v.*

Rheumatoid arthritis
Subchondral cysts
Villous nodular synovitis

Infection

Feline tuberculosis (C)
Leishmaniasis
Mycoplasmosis
Septic arthritis*

Neoplasia

Metastatic digital carcinoma
Synovial sarcoma
Other soft tissue neoplasia

Proliferative joint disease

Disseminated idiopathic skeletal hyperostosis
Enthesopathies
Hypervitaminosis A
Mucopolysaccharidosis
Systemic lupus erythematosus

Neoplasia

Osteoma
Osteosarcoma*
Synovial osteochondroma

Osteoarthritis

Ageing*
Angular limb deformities
Chondrodysplasia
Elbow dysplasia*
Hip dysplasia*
Post articular fractures*
Post surgery*
Other chronic joint stresses
Repeated haemarthroses
Soft tissue damage, e.g.
• Ruptured cranial cruciate ligament*

Soft tissue swelling – joint effusion

Haemarthrosis
Ligament injury
Osteoarthritis
Osteochondrosis
Shar Pei fever (D)
Soft tissue callus
Synovial cyst
Trauma*
Villonodular synovitis

Arthritis

Iatrogenic

- Drugs, e.g.
 - Sulphonamides
- Vaccine reactions

Idiopathic polyarthritis

Immune-mediated disease

- Arthritis of the Akita (D)
- Gastrointestinal disease associated
- Idiopathic
- Neoplasia associated
- Polyarteritis nodosa
- Polyarthritis/meningitis
- Polyarthritis/polymyositis
- Systemic lupus erythematosus
- Vaccine reaction

Infection

- Borreliosis
- Ehrlichiosis
- Sepsis (bacterial)*

Periarticular swelling

Abscess*
Cellulitis*
Haematoma
Neoplasia
Oedema*

3.4 Radiography of the head and neck

3.4.1 Increased radiopacity/bony proliferation of the maxilla

Acromegaly
Healing/healed fracture*
Neoplasia
Osteomyelitis*

3.4.2 Decreased radiopacity of the maxilla

Granuloma
Nasolacrimal duct cysts

Hyperparathyroidism

Nutritional secondary
Primary
Renal secondary*

Neoplasia

Fibrosarcoma
Local extension of tumour, e.g.

- From nasal cavity*

Malignant melanoma
Osteosarcoma*
Squamous cell carcinoma

Odontogenic cysts

Adamantinoma
Ameloblastoma
Complex odontoma
Dentigerous cyst

Periodontal disease*

3.4.3 Increased radiopacity/bony proliferation of the mandible

- Acromegaly
- Canine leukocyte adhesion deficiency (D)
- Craniomandibular osteopathy
- Healing/healed fracture*
- Neoplasia
- Osteomyelitis*

3.4.4 Decreased radiopacity of the mandible

- Granuloma
- Periodontal disease

Hyperparathyroidism

- Nutritional secondary
- Primary
- Renal secondary*

Neoplasia

- Fibrosarcoma
- Malignant melanoma
- Osteosarcoma*
- Squamous cell carcinoma

Odontogenic cysts

- Adamantinoma
- Ameloblastoma
- Complex odontoma
- Dentigerous cyst

3.4.5 Increased radiopacity of the tympanic bulla

Abnormal contents

- Cholesteatoma
- Granuloma

Neoplasia
Otitis media*
Polyp*

Artifact

Positioning

Thickening of the bulla wall

Canine leukocyte adhesion deficiency (D)
Craniomandibular osteopathy
Neoplasia
Otitis media*
Polyp*

3.4.6 Decreased radiopacity of the nasal cavity

Artifact

Turbinate destruction

Aspergillosis
Congenital defect of the hard palate
Chronic rhinitis, e.g. viral
Destruction of the palatine or maxillary bone, e.g.

- Neoplasia*

Foreign body*
Previous rhinotomy

3.4.7 Increased radiopacity of the nasal cavity

Artifact

Epistaxis q.v.

Miscellaneous

Foreign body
Hyperparathyroidism
Kartagener's syndrome

Polyp
Primary ciliary dyskinesia

Neoplasia

*Nasal cavity**

Adenocarcinoma*
Chondrosarcoma
Esthesioneuroblastoma
Fibrosarcoma
Haemangiosarcoma
Histiocytoma
Leiomyosarcoma
Liposarcoma
Lymphoma*
Malignant fibrous histiocytoma
Malignant melanoma
Malignant nerve sheath tumour
Mast cell tumour
Myxosarcoma
Neuroendocrine tumours
Osteosarcoma
Paranasal menigioma
Rhabdomyosarcoma
Squamous cell carcinoma*
Transitional cell carcinoma
Transmissible venereal tumour
Undifferentiated carcinomas*
Undifferentiated sarcoma

Nasal planum

Cutaneous lymphoma
Fibroma
Fibrosarcoma
Haemangioma
Mast cell tumour*
Melanoma
Squamous cell carcinoma

Rhinitis* q.v.

3.4.8 Increased radiopacity of the frontal sinuses

Miscellaneous

Canine leukocyte adhesion deficiency (D)
Craniomandibular osteopathy

Neoplasia

Carcinoma*
Local extension, e.g.

- Nasal tumour*

Osteoma
Osteosarcoma

Obstruction of drainage

Neoplasia*
Trauma*

Sinusitis

Allergic*
Bacterial*
Fungal
Kartagener's syndrome
Viral*

3.4.9 Increased radiopacity of the pharynx

Foreign body*
Mineralisation of laryngeal cartilages
Nasopharyngeal stenosis
Obesity*
Pharyngeal paralysis
Salivary calculi

Pharyngeal soft tissue mass

Abscess*
Granuloma
Nasopharyngeal polyp*
Neoplasia

- Carcinoma
- Lymphoma

Retropharyngeal mass

- Abscess*
- Enlarged lymph nodes*
- Neoplasia, e.g.
 - Lymphoma*

Soft palate thickening

- Brachycephalic obstructive airway syndrome* (D)
- Mass
 - Cyst
 - Granuloma
 - Neoplasia

3.4.10 Thickening of the soft tissues of the head and neck

Diffuse

- Acromegaly
- Cellulitis*
- Cranial vena cava syndrome
- Neoplasia*
- Obesity*
- Oedema*

Focal

- Abscess*
- Cyst*
- Foreign body*
- Granuloma
- Haematoma*
- Iatrogenic, e.g.
 - Subcutaneous fluid administration*
- Neoplasia*

3.4.11 Decreased radiopacity of the soft tissues of the head and neck

Fat

Lipoma*

Obesity*

Gas

Abscess*

Perforation

- Oesophagus
- Pharynx
- Skin
- Trachea

Pneumomediastinum

3.4.12 Increased radiopacity of the soft tissues of the head and neck

Artifact

Calcification

Calcinosis circumscripta

Calcinosis cutis

Calcification of

Abscess

Granuloma

Haematoma

Tumour

Foreign body*

Iatrogenic

Barium

Microchip

Neoplasia

3.5 Radiography of the spine

3.5.1 Normal and congenital variation in vertebral shape and size

Congenital variation

Abnormal dorsal angulation of the dens of C2

Agenesis/incomplete development of the dens of C2

Anomalous development of a transverse process of a lumbar vertebra

Block vertebrae

Butterfly vertebrae

Cervical vertebral malformation–malarticulation syndrome (wobbler syndrome)* (D)

Chondrodystrophic dwarfism

Congenital metabolic disease

- Congenital hypothyroidism
- Pituitary dwarfism

Fused dorsal spinal processes

Hemivertebrae

Mucopolysaccharidosis

Narrowed vertebral canal

- Cervical vertebral malformation–malarticulation syndrome (wobbler syndrome) (D)
- Congenital lumbosacral stenosis
- Secondary to hemivertebrae or block vertebrae
- Thoracic stenosis

Occipital dysplasia

Perocormus

Sacrococcygeal dysgenesis

Scoliosis

Shortened dens of C2

Spina bifida

Spinal stenosis

Transitional vertebrae

Normal variation

C7 may be shorter than adjacent vertebrae.

L7 may be shorter than adjacent vertebrae.

Ventral L3 and L4 may be poorly defined.

3.5.2 Acquired variation in vertebral shape and size

Altered vertebral shape

Hyperparathyroidism

- Nutritional secondary
- Primary
- Renal secondary*

Hypervitaminosis A

Mucopolysaccharidosis

Spondylosis deformans

Trauma

- Fracture*

Neoplasia

Chondrosarcoma

Fibrosarcoma

Haemangiosarcoma

Metastatic neoplasia*

- Haemangiosarcoma
- Lymphosarcoma
- Prostatic carcinoma

Multiple cartilaginous exostoses

Multiple myeloma

Osteochondroma

Osteosarcoma*

Decreased vertebral size

Discospondylitis

Fracture*

Intervertebral disc herniation* (D)

Mucopolysaccharidosis

Nutritional secondary hyperparathyroidism

Increased vertebral size

Baastrup's disease

Bone cyst

Callus formation secondary to trauma/pathological fracture
Disseminated idiopathic skeletal hyperostosis
Hypervitaminosis A
Mucopolysaccharidosis

Neoplasia

Chondrosarcoma
Fibrosarcoma
Haemangiosarcoma
Metastatic neoplasia*, e.g.

- Haemangiosarcoma
- Lymphosarcoma
- Prostatic carcinoma

Multiple cartilaginous exostoses
Osteochondroma
Osteosarcoma*

Spondylitis

Bacterial, e.g.

- Foreign body*
- Haematogenous
- Puncture wound

Fungal, e.g.

- Actinomycosis
- Aspergillosis
- Coccidioidomycosis

Parasitic, e.g.

- *Spirocera lupi*

Protozoal, e.g.

- Hepatozoonosis

Spondylosis deformans

Cervical vertebral malformation–malarticulation syndrome (wobbler syndrome)* (D)
Chronic disc disease* (D)
Degeneration of annulus fibrosis
Discospondylitis
Hemivertebrae
Post surgery
Trauma*

Vertebral canal changes

Widened

Arachnoid cyst
Syringohydromyelia
Tumour

Narrowed

Adjacent bone pathology, e.g.
Callus
Cervical vertebral malformation–malarticulation syndrome
(wobbler syndrome)* (D)
Lumbosacral stenosis

3.5.3 Changes in vertebral radiopacity

Focal or multifocal decrease in radiopacity

Discospondylitis
Osteomyelitis*
Vertebral physisis

Neoplasia

Chondrosarcoma
Fibrosarcoma
Haemangiosarcoma
Metastatic neoplasia
Multiple myeloma
Osteochondroma
Osteosarcoma*

Focal or multifocal increase in radiopacity

Neoplasia

Chondrosarcoma
Fibrosarcoma
Haemangiosarcoma
Metastatic neoplasia*, e.g.

- Haemangiosarcoma
- Lymphoma
- Prostatic carcinoma

Osteochondroma
Osteosarcoma*

Generalised decrease in radiopacity

Disuse atrophy
Hyperadrenocorticism
Hyperparathyroidism

- Nutritional secondary
- Primary
- Pseudohyperparathyroidism*
- Renal secondary*

Hyperthyroidism* (C)
Hypothyroidism* (D)
Osteogenesis imperfecta
Senile osteoporosis

Generalised increase in radiopacity

Osteopetrosis

3.5.4 Abnormalities in the intervertebral space

Disc space – decreased size

Adjacent hemivertebra
Adjacent neoplasia
Artifact

- Divergence of X-ray beam at periphery of radiograph
- Positioning artefact

Cervical vertebral malformation–malarticulation syndrome (wobbler syndrome)* (D)
Degenerative canine lumbosacral stenosis
Discospondylitis
Hansen type I disc extrusion* (D)
Hansen type II disc protrusion* (D)
Post surgery
Spondylosis deformans*
Subluxation
Within block vertebra

Disc space – widened

- Normal variation
- Adjacent to hemivertebra
- Artefact (traction)
- End-plate erosion
 - Discospondylitis
 - Neoplasia
- Mucopolysaccharidosis
- Trauma
 - Luxation
 - Subluxation

Increased radiopacity of disc space

- Artefact
- Superimposition of normal bone/soft tissue
- Incidental mineralisation
- Intervertebral disc disease* (D)

Irregular margination of disc space

- Ageing in cats
- Degenerative intervertebral disc disease
- Discospondylitis
- Mucopolysaccharidosis
- Nutritional secondary hyperparathyroidism
- Spondylosis deformans*

3.5.5 Contrast radiography of the spine (myelography)

Artefact/technical factors

- Contrast medium in soft tissues outside the vertebral canal
- Contrast medium in the spinal parenchyma
- Epidural leakage
- Injection of contrast into the central canal
- Injection of gas into the subarachnoid space
- Subdural injection

Extradural lesions

Congenital abnormalities
Foreign body
Neoplasia

Degenerative

Hansen type I disc extrusion* (D)
Hansen type II disc protrusion* (D)
Hansen type III disc high-velocity low-volume extrusion
Hypertrophied ligamentum flavum
Arachnoid cysts

Inflammatory

Abscess
Granuloma

Trauma

Fracture*
Luxation*

Vascular

Haematoma
Haemorrhage

Intradural/extramedullary

Degenerative

Disc disease

Idiopathic

Intra-arachnoid cyst

Inflammatory

Subdural granuloma

Neoplasia

Lymphoma
Meningioma
Nerve root tumour
Nerve sheath tumour

Vascular

Subarachnoid haematoma
Subarachnoid haemorrhage

Intramedullary

Congenital

Syringohydromyelia* (D)

Degenerative

Disc disease* (D)

Inflammatory

Granulomatous meningoencephalomyelitis

Neoplastic

Ependymoma

Glioma

Lymphoma

Metastatic tumours

Traumatic

Cord swelling

- Concussion
- Disc extrusion

Vascular

Ischaemic myelopathy*

Myelomalacia secondary to infarction

Contrast column splitting

Lateralised extradural compression(s)

Midline extradural compression

3.6 Thoracic ultrasonography

3.6.1 Pleural effusion

(See Section 3.1.13 for full listings)

Bile pleuritis

Blood

Chyle

Exudate

Transudate/modified transudate

3.6.2 Mediastinal masses

Granuloma

Idiopathic mediastinal cysts

Neoplasia

- Lymphoma*
- Mast cell tumour
- Melanoma
- Thymoma*
- Thyroid carcinoma

Reactive lymphadenopathy*

Thymic branchial cysts

3.6.3 Pericardial effusion

Secondary to cardiomyopathy (C)*

Haemorrhagic

Coagulopathy *q.v.*

Left atrial rupture

Idiopathic*(D)

Neoplastic*

Haemangiosarcoma

Heart base tumours

- Chemodectoma
- Metastatic parathyroid tumour
- Metastatic thyroid tumour
- Other metastatic tumours*
- Nonchromaffin paraganglioma

Lymphoma

Mesothelioma

Pericarditis

Bacterial

Bite wounds

Extension of pulmonary infection

- Foreign bodies
- Oesophageal perforation
- Fungal
- Uraemic
- Viral
 - Feline infectious peritonitis* (C)

3.6.4 Altered chamber dimensions

LEFT HEART

Left atrial enlargement

- Chronic bradycardia
- Dilated cardiomyopathy*
- Hyperthyroidism* (C)
- Hypertrophic cardiomyopathy* (C)
- Left-to-right shunt
- Mitral dysplasia
- Myxomatous degeneration of the mitral valve* (D)
- Primary atrial disease
- Restrictive cardiomyopathy (C)

Left ventricle

Dilatation

- Anaemia
- Arteriovenous fistula
- Chronic bradycardia *q.v.*
- Chronic tachyarrhythmia *q.v.*
- Dilated cardiomyopathy
 - Drugs/toxins, e.g.
 - Doxorubicin
 - Idiopathic*
 - Parvovirus
 - Taurine deficiency

- High-output states
 - Anaemia* *q.v.*
 - Hyperthyroidism* (C)

Myocarditis

Volume overload

- Aortic insufficiency
- Left-to-right shunts
 - Arteriovenous fistulas
 - Atrial septal defects
 - Patent ductus arteriosus
 - Ventricular septal defects
- Mitral regurgitation, e.g.
 - Mitral dysplasia
 - Myxomatous degeneration of the mitral valve* (D)

Hypertrophy

Cardiomyopathy

Hypertrophic* (C)

Coarctation of the aorta

Endomyocardial fibrosis

Hyperthyroidism* (C)

Infiltrative cardiac disease, e.g.

- Lymphoma

Pressure overload

- Aortic/subaortic stenosis

- Systemic arterial hypertension*

Pseudohypertrophy from volume depletion*

Reduction

Hypovolaemia *q.v.**

Wall thinning

Aneurysm

Dilated cardiomyopathy*

Infarction

Prior myocarditis

RIGHT HEART

Right atrial enlargement

Anaemia *q.v.*

Arteriovenous fistula

Atrial septal defect

Chronic bradycardia

Cor pulmonale

Dilated cardiomyopathy*

Heartworm disease

Hyperthyroidism* (C)
Hypertrophic cardiomyopathy* (C)
Myxomatous degeneration of the tricuspid valve* (D)
Primary atrial myocardial diseases
Pulmonary hypertension
Restrictive cardiomyopathy (C)
Right-to-left shunts
Tricuspid dysplasia
Tricuspid stenosis/atresia

Right ventricle

Dilatation

Right ventricular volume overload

- Atrial septal defects
- Cardiomyopathy
 - Dilated cardiomyopathy* (D)
 - Hypertrophic cardiomyopathy* (C)
 - Restrictive cardiomyopathy (C)
- Pulmonic insufficiency
- Tricuspid insufficiency
 - Myxomatous degeneration of the tricuspid valve* (D)
 - Tricuspid dysplasia

Hypertrophy

Hypertrophic cardiomyopathy* (C)

Pressure overload

- Cor pulmonale
- Heartworm disease
- Large ventricular septal defect
- Pulmonary hypertension
- Pulmonary thromboembolism
- Pulmonic stenosis
- Tetralogy of Fallot

Restrictive cardiomyopathy (C)

Reduction

Cardiac tamponade

Hypovolaemia* q.v.

3.6.5 Changes in ejection phase indices of left ventricular performance (fractional shortening, FS%; ejection fraction, EF)

Apparently reduced performance (decreased FS%, decreased EF)

Decreased preload, e.g.

Hypovolaemia* *q.v.*

Increased afterload, e.g.

Aortic stenosis

Systemic arterial hypertension* *q.v.*

Reduced systolic function

Canine X-linked muscular dystrophy

Chronic valvular heart disease* (D)

Dilated cardiomyopathy*

Apparently increased performance (increased FS%, increased EF)

Decreased afterload, e.g.

Hypotension

Mitral valve regurgitation*

Increased preload, e.g.

Iatrogenic fluid overload*

Myocardial disease, e.g.

Hypertrophic cardiomyopathy* (C)

3.7 Abdominal ultrasonography

3.7.1 Renal disease

Diffuse abnormalities

Renomegaly *q.v.*

Small kidneys *q.v.*

Increased cortical echogenicity with normal or enhanced corticomedullary definition

End-stage renal disease* *q.v.*

Ethylene glycol toxicity
Fat in the cortex*
Feline infectious peritonitis* (C)
Glomerulonephritis
Interstitial nephritis*
Nephrocalcinosis
Lymphoma
Squamous cell carcinoma

Medullary rim sign

May be normal*
Chronic interstitial nephritis*
Ethylene glycol toxicity
Feline infectious peritonitis* (C)
Hypercalcaemic nephropathy
Idiopathic acute tubular necrosis
Leptospirosis*

Increased cortical echogenicity with reduced corticomedullary definition

Chronic inflammatory disease*
Congenital renal dysplasia
End-stage kidneys*

Reduced cortical echogenicity

Lymphoma

Focal abnormalities

Anechoic/hypoechoic lesions

Abscess
Acquired cysts secondary to nephropathies
Congenital cysts
Cystadenocarcinoma
Haematoma
Lymphoma
Perirenal pseudocyst
Polycystic kidney disease*
Tumour necrosis

Hyperechoic lesions

Calcified abscess
Calcified cyst wall

Calcified haematoma

- Calculi
- Chronic renal infarcts
- Fibrosis
- Gas
- Granuloma
- Neoplasia
 - Chondrosarcoma
 - Haemangioma
 - Haemangiosarcoma
 - Metastatic thyroid adenocarcinoma
 - Osteosarcoma

Mixed echogenicity lesions

- Abscess
- Acute infarct
- Granuloma
- Haematoma
- Neoplasia
 - Adenocarcinoma
 - Haemangioma
 - Lymphoma

Pelvic dilatation

- Contralateral renal disease/absence
(mild dilatation)
- Polyuria/diuresis
- Pyelonephritis
- Renal neoplasia

Congenital conditions

- Ectopic ureter
- Ureteroceles

Hydronephrosis

- Extrinsic mass
- Neoplasia
 - Bladder
 - Prostate
 - Trigone
- Paraureteral pseudocyst
- Ureteral blood clot

Ureteral inflammation
Ureteral stricture
Ureterolith

3.7.2 Hepatobiliary disease

Biliary obstruction (see also Jaundice)

Abscess
Biliary calculi
Gastrointestinal disease* *q.v.*
Granuloma
Hepatobiliary disease* *q.v.*
Lymphadenopathy* *q.v.*
Neoplasia*
Pancreatic disease, e.g. pancreatitis*

Diffuse hepatic disease

Hepatomegaly *q.v.**
Microhepatica *q.v.*

Decreased echogenicity

Amyloidosis
Congestion*
Hepatitis*
Leukaemia
Lymphoma*

Increased echogenicity

Chronic hepatitis*
Cirrhosis*
Fatty infiltration

- Diabetes mellitus*
- Obesity*

Lymphoma*
Steroid hepatopathy*

Mixed echogenicity

Cirrhosis*
Diffuse neoplasia*
Hepatocutaneous syndrome

Dilatation of the caudal vena cava and hepatic veins

Haematological disorders

Systemic infection*

Obstruction of the caudal vena cava/hepatic veins

Budd-Chiari syndrome

Liver disease* *q.v.*

Neoplasia*

Strictures

Thrombosis

Trauma*

Right-sided heart failure*

Cardiac tamponade

Dirofilariasis

Myocardial disease

Pulmonary hypertension

Pulmonic stenosis

Tricuspid insufficiency

Focal or multifocal hepatic parenchymal abnormalities

Nodular hyperplasia (D)*

Abscess

Biliary disease*

Chronic glucocorticoid administration

Diabetes mellitus*

Liver lobe torsion

Neoplasia*

Pancreatitis*

Penetrating foreign body

Cysts

Acquired cysts

- Biloma

- Polycystic renal disease*

Congenital cysts

Cyst-like masses

Biliary pseudocyst

Inflammation

Necrosis
Neoplasia*
Trauma

Haematoma

Coagulopathy *q.v.*
Trauma*

Hepatic necrosis

Chemical insult
Immune mediated*
Infection*
Toxin

Neoplasia

Biliary cystadenoma
Cholangiocellular adenocarcinoma
Cholangiocellular adenoma
Hepatocellular adenocarcinoma*
Hepatocellular adenoma*
Lymphoma*
Metastatic tumours*

**Focal/multifocal increased echogenicity
of the gall bladder**

Biliary calculi
Gall bladder mucocoele
Gall bladder sludge*
Neoplasia
Polyps

Gall bladder wall thickening

Acute hepatitis* *q.v.*
Cholangiohepatitis*
Cholecystitis* *q.v.*
Chronic hepatitis* *q.v.*
Gall bladder mucocoeles
Hypoalbuminaemia* *q.v.*
Neoplasia*
Right-sided congestive heart failure*
Sepsis*

3.7.3 Splenic disease

Diffuse splenic disease – splenomegaly

Amyloidosis
Extramedullary haematopoiesis
Immune-mediated disease*
Infarction
Parenchymal necrosis
Portal hypertension
Splenic vein thrombosis

Congestion

Anaesthetic agents*
Haemolytic anaemia*
Portal vein obstruction
Right-sided heart failure*
Torsion of the splenic pedicle

- Gastric dilatation/volvulus
- Isolated

Toxaemia*
Tranquillizers*

Infection

Bacterial*
Fungal

Neoplasia

Lymphoma*
Lymphoproliferative disease
Malignant histiocytosis
Mastocytosis
Myeloproliferative disease

Parasites

Babesiosis
Ehrlichiosis
Haemotropic *Mycoplasma* spp.

Focal or multifocal splenic disease

Abscess
Fat deposits
Nodular hyperplasia

Haematoma

Abdominal trauma
Coagulopathy

Infarcts

Cardiovascular disease*
Hyperadrenocorticism
Hypercoagulability
Inflammatory diseases

- Endocarditis
- Pancreatitis*
- Septicaemia*

Liver disease* *q.v.*

Neoplasia*

- Fibrosarcoma
- Haemangioma
- Haemangiosarcoma
- Leiomyosarcoma
- Lymphoma

Renal disease* *q.v.*

Neoplasia

Chondrosarcoma
Fibrosarcoma
Fibrous histiocytoma
Haemangioma*
Haemangiosarcoma*
Leiomyosarcoma
Liposarcoma
Lymphoma*
Metastatic tumours*
Myxosarcoma
Osteosarcoma
Rhabdomyosarcoma
Undifferentiated sarcoma

3.7.4 Pancreatic disease

Focal pancreatic lesions

Abscess (D)
Cyst-like structures

- Congenital cysts
- Pseudocysts
- Retention cysts

Neoplasia

Nodular changes

Diffuse enlargement

Pancreatic neoplasia

Pancreatic oedema

Pancreatitis*

3.7.5 Adrenal disease

Adrenomegaly

Unilateral

Adrenal tumour

- Adrenocortical adenocarcinoma*
- Adrenocortical adenoma*
- Blastoma
- Metastatic tumours
- Pheochromocytoma

Bilateral

Adrenal tumours

- Adrenocortical adenocarcinoma*
- Adrenocortical adenoma*
- Metastatic tumours

Drugs

- Trilostane

Hyperplasia

Pituitary-dependent hyperadrenocorticism*

Stressful non-adrenal illness*

3.7.6 Urinary bladder disease

Increased wall thickness

Diffuse

Chronic cystitis*

Emphysematous cystitis

- Clostridial infection
- Diabetes mellitus

Empty bladder*

Fibrosis/calcification of the bladder wall

Focal or multifocal

Mural haematomas

- Coagulopathy *q.v.*
- Iatrogenic
- Infection
- Neoplasia
- Trauma

Neoplasia

- Adenocarcinoma
- Chemodectoma
- Fibroma
- Fibrosarcoma
- Haemangioma
- Haemangiosarcoma
- Leiomyoma
- Leiomyosarcoma
- Lymphoma
- Myxoma
- Rhabdomyosarcoma
- Squamous cell carcinoma
- Transitional cell carcinoma
- Undifferentiated carcinoma

Focal wall defects

Acquired diverticulum

Patent urachus

Urachal diverticulum

Ureterocoele

Intraluminal lesions, e.g.

Blood clots*

Foreign bodies

Gas bubbles

Sediment*

Uroliths*

3.7.7 Gastrointestinal disease

Increased wall thickness

Diffuse

Acute haemorrhagic gastroenteritis*

Colitis* *q.v.*

Gastritis*

- Dietary*
- Infectious*
- Parvovirus*
- Inflammatory*
- Uraemic* *q.v.*

Inflammatory bowel disease*

Neoplasia

- Lymphoma*

Focal/multifocal

Benign adenomatous polyps

Chronic hypertrophic gastropathy

Congenital hypertrophic pyloric stenosis

Inflammatory bowel disease*

Intussusception (apparent)

Neoplasia

- Adenocarcinoma
- Adenoma
- Carcinoid tumours
- Carcinoma
- Leiomyoma
- Leiomyosarcoma
- Lymphoma
- Neurilemmoma

Decreased intestinal motility (ileus)

Functional

Abdominal pain*

Acute gastroenteritis*

Amyloidosis

Neurogenic disease

Oedema

Post-operative abdomen*

Vascular disease

Drugs

Mechanical

Adhesions*

Foreign body*

Intussusception

Localised inflammation*

Neoplasia

3.7.8 Ovarian and uterine disease

Ovarian masses

Ovarian stump granuloma

*Cysts**

Follicular

Luteinising

Neoplasia

Adenoma

Adenocarcinoma

Dysgerminoma

Granulosa cell tumour

Luteoma

Teratoma

Thecoma

Uterine enlargement

Haemometra

Hydrometra

Mucometra

Post partum*

Pregnancy*

Pyometra*

Uterine wall thickening

Neoplasia

Adenocarcinoma

Adenoma

Fibroma
Fibrosarcoma
Leiomyoma
Leiomyosarcoma
Lymphoma

3.7.9 Prostatic disease

Prostatic enlargement

Diffuse

Bacterial prostatitis*
Benign prostatic hyperplasia*
Neoplasia
Squamous metaplasia

Focal lesions

Abscessation
Cysts

- Paraprostatic
- Prostatic

Neoplasia

- Adenocarcinoma
- Fibroma
- Leiomyoma
- Leiomyosarcoma
- Squamous cell carcinoma
- Transitional cell carcinoma
- Undifferentiated carcinoma

3.7.10 Ascites

Bile – ruptured biliary tract

Neoplasia
Post surgery, e.g.

- Cholecystectomy

Severe cholecystitis*
Trauma

Blood

Coagulopathy
Neoplasia, e.g.

- Haemangiosarcoma*

Organ or major blood vessel rupture
Thrombosis
Trauma
Vasculitis

Chyle

Congestive heart failure
Feline infectious peritonitis (C)
Lymphangiectasia
Lymphangiosarcoma
Lymphoma
Mesenteric root strangulation
Ruptured cisterna chyli

- Neoplasia
- Trauma

Steatitis

Exudate

Diaphragmatic hernia
Feline infectious peritonitis* (C)
Hepatitis
Neoplasia
Organ torsion
Pancreatitis
Percardiodiaphragmatic hernia

Septic peritonitis

Abscess
Haematogenous spread
Iatrogenic/nosocomial
Local extension of infection from elsewhere
Migrating foreign body
Neoplasia*
Pancreatitis*
Penetrating wound
Primary

Ruptured viscus, e.g.

- Neoplasia
- Post surgery, e.g.
 - Enterotomy wound dehiscence*
- Pyometra
- Trauma

Steatitis

Transudate/modified transudate

Cardiac tamponade *q.v.*

Caudal vena caval obstruction

Hepatic disease

- Cholangiohepatitis* *q.v.*
- Chronic hepatitis* *q.v.*
- Cirrhosis*
- Fibrosis*
- Portal hypertension

Hypoalbuminaemia* *q.v.*

Inflammation

- Feline infectious peritonitis

Neoplasia*

Portal hypertension

Right-sided heart failure*

Ruptured cyst

Splenic disease

Urine – lower urinary tract rupture

Bladder

Ureter

Urethra

3.8 Ultrasonography of other regions

3.8.1 Testes

Enlargement

Neoplasia*

Orchitis

Torsion

Focal lesions – neoplasia

Interstitial cell tumour*

Seminoma*

Sertoli cell tumour*

3.8.2 Eyes

Intraocular masses

Foreign body*

Inflammation*

Infection*

Bacteria

Fungi

- Blastomycosis
- Coccidioidomycosis
- Cryptococcosis
- Histoplasmosis

Viral

- Feline infectious peritonitis* (C)

Neoplasia

Ciliary body adenocarcinoma

Ciliary body adenoma

Lymphoma

Medulloepithelioma

Melanoma

Metastatic cancer

Squamous cell carcinoma

Organised haemorrhage*

Chronic glaucoma

Coagulopathy *q.v.*

Diabetes mellitus*

Hypertension* *q.v.*

Neoplasia

Neovascularisation

Persistent hyaloid artery

Trauma*

Vitreoretinal disease

Point-like and membranous lesions of the vitreous chamber

- Asteroid hyalosis
- Endophthalmitis
- Foreign body
- Haemorrhage (see preceding text)
- Persistent hyperplastic primary vitreous
- Posterior vitreal detachment
- Vitreous floaters
- Vitreous membrane formation

Retinal detachment q.v.

Retrobulbar masses

*Abscess/cellulitis**

- Extension from nasal cavity
- Extension from paranasal sinuses
- Extension from tooth root infection*
- Extension from zygomatic salivary gland
- Foreign body
- Haematogenous spread
- Oral inflammatory disease
- Penetrating wound

Neoplasia

- Metastatic tumours
- Chondrosarcoma
- Haemangiosarcoma
- Lacrimal gland tumour
- Lymphoma
- Meningioma
- Nasal adenocarcinoma
- Neurofibrosarcoma
- Osteosarcoma
- Rhabdomyosarcoma
- Squamous cell carcinoma
- Zygomatic gland tumour
- Primary epithelial and mesenchymal tumours

3.8.3 Neck

Enlarged parathyroid gland(s)

Neoplasia

- Adenocarcinoma
- Adenoma

Hyperplasia

- Nutritional secondary hyperparathyroidism
- Renal secondary hyperparathyroidism

Enlarged thyroid gland(s)

Miscellaneous

- Thyroid cyst
- Thyroiditis

Neoplasia

- Adenocarcinoma*
- Adenoma*

Lymph node enlargement

Inflammation/infection

- Abscess*
- Inflammation*

Neoplasia

- Lymphoma*
- Metastatic neoplasia*

Salivary gland enlargement

- Salivary cysts

- Retention cyst

- True cyst

- Salivary gland abscess*

- Salivary gland neoplasia

- Sialadenitis/sialadenosis

- Sialocoele*

- Sialolithiasis

Neck masses at other sites

Inflammation/infection

- Abscess*
- Cellulitis
- Granuloma

Neoplasia

- Lipoma*
- Metastatic neoplasia
- Primary neoplasia

Miscellaneous

- Arteriovenous malformation
- Cyst*
- Haematoma*

PART 4

LABORATORY FINDINGS

In order to avoid repetition, ‘laboratory error’ has been omitted from the differential diagnoses in this chapter. However, it should always be borne in mind that factors such as mislabelling or misidentification of samples, errors introduced by the laboratory machinery (especially certain in-house laboratories where quality control is inadequate) and errors due to ageing samples or incorrect collection techniques can all cause apparent abnormalities. Where a test result is unexpectedly abnormal, it should be repeated, preferably by a different method. It is also important to remember that reference intervals are usually based on the values into which 95% of the healthy population would fall, so small changes outside these values may not be significant. Finally, each laboratory establishes its own reference intervals, due to differences in testing methodology and local factors, and thus when comparing results over a course of time, it is best to use the same laboratory.

4.1 Biochemical findings

4.1.1 Albumin

Decreased

Relative (dilutional)

Decreased production

Chronic inflammatory disease*

Hepatic failure* *q.v.*

Decreased protein intake

Malabsorption*

Maldigestion

Malnutrition

Increased loss

Cutaneous lesions, e.g.

- Burns

External haemorrhage*, e.g.

- Coagulopathy *q.v.*
- Gastrointestinal neoplasia
- Gastrointestinal ulceration
- External parasites
- Trauma

Protein-losing enteropathy*

- Acute gastrointestinal infection, e.g. viral
- Cardiac disease
- Inflammatory bowel disease
- Gastrointestinal neoplasia
- Gastrointestinal parasitism
- Gastrointestinal ulceration
- Lymphangiectasia
 - Intestinal inflammation
 - Intestinal neoplasia
 - Lymphangitis
 - Primary/congenital
 - Venous hypertension
 - Protein-losing nephropathy *q.v.*

Sequestration

Body cavity effusion* *q.v.*

Increased

Artefact

- Lipaemia

Haemoconcentration*

- Dehydration

4.1.2 Alanine transferase

Decreased (minimal clinical significance)

Chronic liver disease

Normal variation*

Nutritional deficiency

- Vitamin B6
- Zinc

Increased

Artefact

Haemolysis

Lipaemia

Drugs/toxins

Barbiturates

Cimetidine

Colchicine

Cyclophosphamide

Danazol

Diazepam (C)

Glucocorticoids

Griseofulvin

Itraconazole

Ketoconazole

Methimazole

Methotrexate

Metronidazole

Mexiletine

Nandrolone

NSAIDs, e.g.

- Ibuprofen
- Paracetamol
- Phenylbutazone

Oxytetracycline

Phenobarbitone

Phenylbutazone

Phenytoin

Primidone

Procainamide
Salicylates
Tetracycline
Trimethoprim/sulphonamide

Extrahepatic disease

Anoxia
Endocrine disease, e.g.

- Hyperadrenocorticism
- Hyperthyroidism (C)
- Diabetes mellitus

Inflammatory disease, e.g.

- Pancreatitis
- Muscle disease, e.g. muscular dystrophy (D), trauma

Hepatic disease

Cholangiohepatitis* *q.v.*
Cholangitis* *q.v.*
Chronic hepatitis* *q.v.*
Cirrhosis*
Copper storage disease (D)
Feline infectious peritonitis* (C)
Hepatotoxin
Lipidosis
Neoplasia, e.g.

- Hepatocellular adenocarcinoma*
- Lymphoma*

Trauma*

4.1.3 Alkaline phosphatase

Increased

Normal in young growing animals*

Artefact

Haemolysis
Hyperbilirubinaemia
Lipaemia

Drugs/toxins

Aflatoxin
Barbiturates
Cimetidine
Colchicine
Cyclophosphamide
Danazol
Diazepam (C)
Glucocorticoids
Griseofulvin
Itraconazole
Ketoconazole
Methimazole
Methotrexate
Metronidazole
Mexiletine
Nandrolone
NSAIDs, e.g.

- Ibuprofen
- Paracetamol
- Phenylbutazone

Oxytetracycline
Phenobarbitone
Phenoxy acid herbicides
Phenylbutazone
Phenytoin
Primidone
Procainamide
Salicylates
Trimethoprim/sulphonamide

Extrahepatic disease

Bile duct neoplasia
Bone disease, e.g.

- Fracture
- Osteomyelitis

Cholecystitis*
Cholelithiasis
Diabetes mellitus*
Diaphragmatic hernia*

Ehrlichiosis
Gall bladder mucocoele
Hyperadrenocorticism
Hyperthyroidism (C)*
Pancreatic neoplasia
Pancreatitis*
Right-sided congestive heart failure*
Septicaemia*

Hepatic disease

Cholangiohepatitis* *q.v.*
Chronic hepatitis* *q.v.*
Cirrhosis* *q.v.*
Copper storage disease (D)
Feline infectious peritonitis* (C)
Hepatic lipidosis (C)
Hepatic neoplasia*, e.g.

- Haemangiosarcoma
- Hepatocellular carcinoma
- Lymphoma
- Metastatic carcinoma

4.1.4 Ammonia

Decreased (minimal clinical significance)

Drugs

Diphenhydramine
Enemas
Lactulose
Oral antibiotics, e.g.

- Aminoglycosides
- Probiotics

Increased

Artefact

Delay in sample analysis
Fluoride/oxalate anticoagulants
Strenuous exercise

Drugs

Ammonium salts
Asparaginase
Diuretics

Hepatic insufficiency

Decreased functional hepatic mass, e.g.

- Diffuse chronic hepatic disease

Decreased portal blood flow to the liver, e.g.

- Acquired portosystemic shunt
- Congenital portosystemic shunt

Miscellaneous

High-protein diet*
Intestinal haemorrhage
Urea cycle disorders
Selective cobalamin deficiency, e.g. border collie

4.1.5 Amylase

Increased

Drugs/toxins

Azathioprine
Carbamate
Diazoxide
Frusemide
Glucocorticoids
L-Asparaginase
Metronidazole
Oestrogens
Potassium bromide
Sulphonamides
Tetracyclines
Thiazide diuretics

Intestinal disease*

*Pancreatic disease**

Necrosis
Neoplasia

Pancreatic duct obstruction
Pancreatitis*

Reduced glomerular filtration q.v.

Pre-renal disease*
Renal disease*
Post-renal disease*

4.1.6 Aspartate aminotransferase

Increased

Artefact

Haemolysis
Lipaemia

Drugs/toxins

Barbiturates
Carbamate
Glucocorticoids
Griseofulvin
Ketoconazole
NSAIDs, e.g.

- Ibuprofen
- Paracetamol
- Phenobarbitone
- Phenylbutazone
- Primidone
- Salicylates

*Haemolysis**

Hepatic disease q.v.*

*Muscle damage**

Exercise
Inflammation
Intramuscular injection
Ischaemia
Necrosis
Neoplasia
Trauma

4.1.7 Bilirubin

Decreased (minimal clinical significance)

Artefact

Prolonged exposure to sunlight
or fluorescent light

Increased (see also Jaundice)

Artefact

Haemolysis
Lipaemia

Drugs/toxins

Barbiturates
Blue-green algae
Glucocorticoids
Glyphosphate
Griseofulvin
Ketoconazole
Metronidazole
Phenobarbitone
Plastic explosives
Primidone
NSAIDs, e.g.

- Ibuprofen
- Paracetamol
- Phenylbutazone

Salicylates

Pre-hepatic

Haemolysis*

Hepatic, e.g.

Diffuse hepatocellular disease
Cholestatic liver disease* *q.v.*

Post-hepatic, e.g.

Biliary obstruction* *q.v.*

Miscellaneous

Bile sludging with dehydration and anorexia (C)

Decreased rate of excretion (functional cholestasis) in sepsis

4.1.8 Bile acids/dynamic bile acid test

Failure to stimulate

Cholestyramine

Delayed gastric emptying

Failure to feed a sufficiently high-fat meal for bile acid stimulation test

Malabsorption

Rapid intestinal transit time

Normal

Increased

Artefact

Haemolysis

Lipaemia

Decreased bile acid removal from portal blood

Portosystemic shunt

- Acquired
- Congenital

Decreased excretion bile acids

Hepatic disease

Cholestatic disease* *q.v.*

Hepatic parenchymal disease* *q.v.*

Secondary hepatic disease*

Drugs

- Ursodeoxycholic acid

4.1.9 C-reactive protein (D)

Decreased

Severe obesity

Increased

Extreme exercise

Inflammation*, e.g.

Arthritis (including IMPA)
Haemolytic anaemia, pancreatitis, SRMA
Infection, e.g.
Bordetella
E. coli
Ehrlichia
Leishmania
Parvovirus
Pyometra
Neoplasia*, e.g.
Haemangiosarcoma
Leukaemia
Lymphoma
Parturition*
Pregnancy (period of time)
Tissue trauma*

4.1.10 Cholesterol

Decreased

Artifact

Intravenous dipyrone

Drugs

Azathioprine
Oral aminoglycosides

Gastrointestinal

Hepatic insufficiency* *q.v.*
Maldigestion/malabsorption* *q.v.*
Protein-losing enteropathy* *q.v.*

Increased

Idiopathic hyperlipidaemia
Postprandial hyperlipidaemia

Artifact

Hyperbilirubinaemia
Lipaemia

Drugs

Corticosteroids
Phenytoin
Thiazide diuretics

Breed related

Hypercholesterolaemia of the briard, rough collie and Shetland sheepdog (D)

Secondary hyperlipidaemia

Cholestatic disease* *q.v.*
Diabetes mellitus*
Hyperadrenocorticism
Hypothyroidism* (D)
Nephrotic syndrome
Pancreatic disease
Protein-losing nephropathy

4.1.11 Creatinine

Decreased

Poor body condition

Increased

Increased protein catabolism, e.g. heavily muscled dogs
Pre-renal azotaemia*
Renal azotaemia*

- Acute kidney injury
- Chronic kidney disease

Post-renal azotaemia*

- (See Urea *q.v.*)

4.1.12 Creatine kinase

Mild increase (e.g. 2–3x upper reference interval)

Intramuscular injections*
Muscle biopsy
Muscle damage
Physical activity*

Prolonged recumbency*
Restraint*

Moderate to marked increase

Anorexia
Convulsions*
Endocrine, e.g.
Hyperadrenocorticism
Hypothyroidism (D)
Hyperthyroidism (C)

Feline lower urinary tract disease

Masticatory myopathy

Muscle damage

Myopathies

- *Inherited, e.g.*
Hereditary Labrador retriever myopathy
Muscular dystrophy
Myotonia
- *Inflammatory/infectious, e.g.*
Immune-mediated polymyositis
Neosporosis
Toxoplasmosis
- *Nutritional, e.g.*
Selenium deficiency
Vitamin E deficiency

Neuropathies

Toxins, e.g.

- Carbamate
- Lily poisoning
- Monensin
- Phenoxy acid herbicides

Thromboembolic disease

Trauma*

Tremors/shivering *q.v.*

4.1.13 Ferritin

Decreased

Iron deficiency disorders *q.v.*
Acute/chronic inflammation

Portosystemic shunts
Young animals

Increased

Cortisol excess (D)
Haemolysis*
Iatrogenic, e.g.

- Injections, diet

Inflammation*
Liver disease*
Neoplasia*

- Lymphoma

Repeated blood transfusions

4.1.14 Fibrinogen

Decreased

Artefact

- Clot
- Incorrect anticoagulant

Disseminated intravascular coagulation*
Excessive blood loss*
Hereditary fibrinogen deficiency/abnormality
Severe hepatic insufficiency

Increased

Breed related

- Cavalier King Charles spaniels

Haemoconcentration
Inflammation*
Parturition*
Pregnancy*
Renal disease*

4.1.15 Folate

Decreased

Dietary deficiency
Proximal small intestinal disease*

Increased

Dietary/parenteral supplementation
Exocrine pancreatic insufficiency
Small intestinal bacterial overgrowth*

4.1.16 Fructosamine

Decreased

Hyperthyroidism (C)
Insulin overdosage
Persistent hypoglycaemia *q.v.*, e.g.
• Insulinoma

Increased

Hypothyroidism (D)*
Persistent hyperglycaemia, e.g.
• Diabetes mellitus*

4.1.17 Gamma-glutamyl transferase

Increased*Artifact*

Lipaemia

Drugs

Barbiturates
Glucocorticoids
Griseofulvin
Ketoconazole
NSAIDs, e.g.
• Ibuprofen
• Paracetamol
• Phenylbutazone

Phenobarbitone

Primidone

Salicylates

Extrahepatic disease

Bile duct neoplasia
Cholecystitis*
Cholelithiasis
Diabetes mellitus*
Diaphragmatic hernia*
Gall bladder mucocoele
Hyperadrenocorticism
Hyperthyroidism (C)*
Pancreatic neoplasia
Pancreatitis*
Right-sided congestive heart failure*
Septicaemia*

Hepatic disease

Cholangiohepatitis* *q.v.*
Chronic hepatitis* *q.v.*
Cirrhosis* *q.v.*
Copper storage disease (D)
Feline infectious peritonitis* (C)
Hepatic lipidosis (C)
Hepatic neoplasia*, e.g.

- Haemangiosarcoma
- Hepatocellular carcinoma
- Lymphoma
- Metastatic carcinoma

4.1.18 Gastrin

Increased

Antral G-cell hyperplasia
Atrophic gastritis
Chronic omeprazole administration
Gastric outlet obstruction
Gastrinoma
Hyperparathyroidism
Renal disease* *q.v.*
Short bowel syndrome

4.1.19 Globulins

Decreased

Normal in greyhounds

External haemorrhage, e.g.

- Coagulopathy *q.v.*
- Gastrointestinal neoplasia
- Gastrointestinal ulceration
- Trauma*

Hepatic insufficiency* *q.v.*

Neonate*

Protein-losing enteropathies* *q.v.*

Increased

Polyclonal

Dehydration

Infectious disease

- Bacterial disease*, e.g.

- Bacterial endocarditis
 - Brucellosis
 - Pyoderma*

Fungal disease, e.g.

- Blastomycosis
 - Coccidioidomycosis
 - Histoplasmosis

Parasitic disease*, e.g.

- Demodicosis*
- Dirofilariasis
- Scabies*

Protozoal disease

Rickettsial disease, e.g.

- Ehrlichiosis

- Viral disease*, e.g.

- Feline immunodeficiency virus* (C)
- Feline infectious peritonitis* (C)
- Feline leukaemia virus* (C)

Immune mediated/inflammatory

Acute inflammatory response, e.g.

- Hepatitis*

- Nephritis*
 - Suppurative diseases*
- Allergies*
- Autoimmune polyarthritis
 - Bullous pemphigoid
 - Immune-mediated haemolytic anaemia
 - Immune-mediated thrombocytopenia
 - Pemphigus complex
 - Systemic lupus erythematosus
- Neoplasia
- Lymphoma

Monoclonal/oligoclonal

- Cutaneous amyloidosis
- Idiopathic
- Macroglobulinaemia
- Plasmacytic gastroenterocolitis
- Infectious
 - Ehrlichiosis
 - Leishmaniasis
- Neoplastic
 - Extramedullary plasmacytoma
 - Lymphoma*
 - Multiple myeloma

4.1.20 Glucose

Decreased

- Polycythaemia *q.v.*
- Renal disease* *q.v.*
- Sepsis*

Artifact

Prolonged contact of serum/plasma with erythrocytes

Drugs/toxins

- Anabolic steroids
- Beta blockers, e.g.
 - Propranolol

Ethanol
Ethylene glycol
Insulin
Salicylates
Sulphonylurea
Xylitol

Endocrine

Growth hormone deficiency
Hypoadrenocorticism (D)
Hypopituitarism
Insulinoma

Hepatic

Hepatic failure

- Cirrhosis*
- Hepatic necrosis, e.g.
 - Infection
 - Toxin
 - Trauma
- Portosystemic shunts (acquired or congenital)

Idiopathic

Juvenile
Neonatal

*Neoplastic**

Hepatic leiomyoma/leiomyosarcoma
Hepatic/splenic haemangiosarcoma
Hepatocellular carcinoma
Pancreatic

Substrate deficiency

Glycogen storage disease
Hunting dog hypoglycaemia
Juvenile hypoglycaemia
Neonatal hypoglycaemia
Pregnancy hypoglycaemia
Reduced dietary intake of glucose or its precursors, e.g.

- Severe malnutrition

Sepsis

Increased

Excitement

Pancreatitis* (and other pancreatic diseases)

Parenteral nutrition

Postprandial

Renal insufficiency* *q.v.*

Stress hyperglycaemia*

Supplementation, e.g. IV fluids

Artifact

Azotaemia

Drugs/toxins

Daffodil

Ethylene glycol

Glucagon

Glucocorticoids

Hydrochlorothiazide

Ketamine

Megestrol acetate

Oestrogens

Phenytoin

Progestagens

Snake venom

Thiazide diuretics

Xylazine (and other alpha-2 agents)

Endocrine

Acromegaly

Diabetes mellitus*

Hyperadrenocorticism

Hyperpituitarism

Hyperthyroidism

Pheochromocytoma

Progesterone induced, e.g.*

Dioestrus

Lactation

Pregnancy

4.1.21 Iron

Decreased

Acute phase inflammatory reactions*
Chronic inflammatory disease*
Hypothyroidism (D)
Portosystemic shunt
Renal disease* *q.v.*

*Chronic external blood loss**, e.g.

Chronically bleeding external masses*

External parasites, e.g.

- Heavy flea burden*

Gastrointestinal*, e.g.

- Clotting disorder *q.v.*
- Neoplasia
- Parasitism
- Ulceration

Decreased intake

Milk-only diet in immature animals

Neoplasia

Lymphoma

Osteosarcoma

Increased

Haemolysis* *q.v.*

Ingestion of iron supplements/parenteral overdose

Liver disease* *q.v.*

Refractory anaemia

4.1.22 Lactate dehydrogenase

Increased

Artefact

Haemolysis

Sample ageing

Cardiac muscle disorders

Degeneration

Ischaemia

- Aortic thromboembolism*
- Bacterial endocarditis
- Dirofilariasis
- Myocardial infarction

Neoplasia

Trauma

Miscellaneous

Hepatocellular damage* *q.v.*

Hyperthyroidism* (C)

*Respiratory disease**

Necrosis

Pulmonary thromboembolism

Skeletal muscle disorders

Exertional rhabdomyolysis

Neoplasia*

Seizures*

Trauma*

Endocrine

Hyperadrenocorticism*

Hypothyroidism* (D)

Inflammatory/infectious

Bacterial*

Protozoal*

Idiopathic

Idiopathic polymyositis

Masticatory myopathy

Inherited myopathies

Hereditary Labrador retriever myopathy

Muscular dystrophy

Myotonia

Metabolic

- Glycogen storage diseases
- Mitochondrial myopathy

Nutritional

- Vitamin E deficiency

Vascular

- Aortic thromboembolism* (C)

4.1.23 Lipase

Decreased***Artifact***

- Haemolysis
- Hyperbilirubinaemia
- Lipaemia

Increased***Drugs***

- Azathioprine
- Diazoxide
- Frusemide
- Glucocorticoids
- L-Asparaginase
- Metronidazole
- Oestrogens
- Potassium bromide
- Sulphonamides
- Tetracyclines
- Thiazide diuretics

Pancreatic disease

- Necrosis
- Neoplasia
- Pancreatic duct obstruction
- Pancreatitis*

Reduced glomerular filtration

Pre-renal disease* *q.v.*

Renal disease* *q.v.*

Post-renal disease* *q.v.*

4.1.24 Triglycerides

Decreased

Artefact

- Intravenous dipyrone

Hyperthyroidism* (C)

Protein-losing enteropathy*

Drugs

- Ascorbic acid therapy

Increased

Artefact

- Hyperbilirubinaemia

Postprandial*

Drugs

Glucocorticoids

Megestrol acetate

Primary/idiopathic hyperlipidaemia

Familial hyperchylomicronaemia in the cat

Idiopathic hypertriglyceridaemia of the miniature schnauzer

Idiopathic hypertriglyceridaemia

Lipoprotein lipase deficiency (C)

Transient hyperlipidaemia and anaemia in kittens (C)

Secondary hyperlipidaemia

Acute pancreatitis*

Cholestasis*

Diabetes mellitus*

Hepatic insufficiency* *q.v.*

Hyperadrenocorticism

Hypothyroidism* (D)

Nephrotic syndrome

4.1.25 Troponin

Increased

Cardiac disease, e.g.

- Aortic stenosis
- Arrhythmogenic right ventricular cardiomyopathy
- Bradyarrhythmias
- Dilated cardiomyopathy
- Mitral valve disease
- Pericardial effusion
- Pulmonary hypertension
- Pulmonic stenosis

Drugs/toxins

- Albuterol
- Anaesthesia/sedation
- Benfluorex
- Doxorubicin
- Oleander
- Phenazopyridine
- Phenylpropanolamine
- Ractopamine
- Viper envenomation

Infections

- Babesiosis
- Dirofilariasis
- Ehrlichiosis
- Leishmaniasis
- Pyometra

Miscellaneous

- Anaemia
- Azotaemia/renal disease
- Brachycephalic obstructive airway syndrome
- Gastric dilatation and volvulus
- Heat stroke
- Hyperadrenocorticism
- Hypoadrenocorticism

Neoplasia, e.g. lymphoma
Pancreatitis
Steroid-responsive meningitis-arteritis

Physiological

Breed variation (greyhounds)
High-intensity exercise
Old age

4.1.26 Trypsin-like immunoreactivity

Decreased

Exocrine pancreatic insufficiency
Very-low-protein diet

Increased

High-protein diet
Pancreatitis*
Post-pancreatic obstruction
Reduced glomerular filtration rate

4.1.27 Urea

Increased

Pre-renal
Dehydration*
Gastrointestinal bleeding
Heart failure*
High-protein diet*
Hypoadrenocorticism (D)
Increased catabolic state, e.g.

- Fever*

Shock* *q.v.*
Tetracyclines

Renal

Acute kidney injury
Diabetes mellitus*

Drugs/toxins

- ACE inhibitors
- Anaesthetics
- Antibiotics, e.g.
 - Aminoglycosides
 - Amphotericin B
 - Cephalosporins
 - Tetracyclines
- Borax
- Calcium edetate
- Chemotherapeutics, e.g.
 - Cisplatin
- Cimetidine
- Corticosteroids
- Dipyrone (metamizole)
- Heavy metals, e.g.
 - Arsenic
 - Lead
 - Mercury
- Hymenoptera stings
- Intravenous radiographic contrast agents
- Iron/iron salts

Lily ingestion (C)

Melamine toxicity

Methylene blue

- NSAIDs
- Organic compounds, e.g.
 - Ethylene glycol
 - Herbicides
 - Pesticides
- Pigments, e.g.
 - Myoglobin/haemoglobin
 - Paraquat
 - Plastic explosives
 - Salt
 - Snake venom

Hypercalcaemia

Immune-mediated diseases, e.g.

- Glomerulonephritis
- Systemic lupus erythematosus

Infection e.g.

- Leptospirosis
- Pyelonephritis

Ischaemia

- Decreased cardiac output*
- Extensive burns
- Hyper-/hypothermia* *q.v.*
- Prolonged anaesthesia*
- Renal vessel thrombosis
- Shock, e.g.
 - Hypovolaemia
 - Sepsis*
- Transfusion reactions
- Trauma*

Urinary tract obstruction*

Chronic kidney disease, e.g.

Subsequent to acute kidney injury

Glomerulonephritis*

Interstitial nephritis*

Nephrotoxins

Post-renal

Bladder obstruction*, e.g.

- Blood clot
- Neoplasia
- Polyp*
- Urolith*

Bladder trauma

Ureteral obstruction (may need to be bilateral
to cause azotaemia)

Urethral obstruction, e.g.

- Neoplasia
- Urolith

Urethral trauma

Uroabdomen

Decreased

Normal in neonates*

- Dialysis/over-hydration
- Diuresis, e.g.
 - Fluid and drug therapy*
- Liver insufficiency, e.g.
 - Cirrhosis
 - Portosystemic shunt*
- Low-protein diet/malnutrition*
- Polyuria *q.u.*, e.g.
 - Diabetes insipidus
 - Hyperadrenocorticism
- Pregnancy*
- Urea cycle enzyme deficiency

4.1.28 Vitamin B12 (cobalamin)

Decreased

- Exocrine pancreatic insufficiency
- Hepatic lipidosis (C)
- Inflammatory biliary tract disorders
- Inherited defect of absorption, e.g. border collie
- Intestinal mucosal disease*
- Pancreatitis

Increased

- Vitamin B12 supplementation

4.1.29 Zinc

Decreased

- Decreased dietary intake
- Zinc-responsive dermatosis

Increased

- Ingestion of zinc-containing objects, e.g.
 - Coins

4.2 Haematological findings

4.2.1 Regenerative anaemia

HAEMORRHAGE

Internal

- Bleeding tumour*
- Coagulopathy *q.v.*
- Traumatic injury*

External

- Bleeding tumour*
- Coagulopathy *q.v.*
- Epistaxis *q.v.*
- Haematemesis *q.v.*
- Haematuria *q.v.*
- Intestinal blood loss *q.v.*
- Traumatic injury*

Parasitism*

- Ancylostoma* spp.
- Fleas
- Lice
- Ticks
- Uncinaria* spp.

HAEMOLYSIS

Acquired defects of red cells

- Hypophosphataemia

Chemical damage

- Copper
- Cyclic hydrocarbons
- Heavy metals
- Propylene glycol

Oxidative damage (Heinz body anaemia)

- Benzocaine toxicity
- DL-methionine toxicity

Garlic toxicity
Glycol toxicity
High doses of vitamin K
Lymphoma
Metabolic disease

- Diabetes mellitus*
- Hyperthyroidism* (C)
- Renal disease*

Methylene blue
Onion toxicity
Paracetamol toxicity
Phenazopyridine (C)
Phenolic compound toxicity, e.g.

- Mothballs

Propylene toxicity
Vitamin K3 toxicity
Zinc toxicity

Genetic defects of red cells

Feline porphyria
Hereditary elliptocytosis
Hereditary haemolysis in Abyssinian and Somali cats (C)
Hereditary stomatocytosis
Methaemoglobin reductase deficiency
Non-spherocytic haemolytic anaemia of beagles (D)
Phosphofructokinase deficiency (D)
Pyruvate kinase deficiency

Immune mediated

Primary (autoimmune haemolytic anaemia)*

Drugs/toxins

Anti-arrhythmics
Anticonvulsants
Bee envenomation
Cephalosporins
Chlorpromazine
Copper
Dipyrone
Levamisole
Methimazole

Methylene blue
NSAIDs, e.g.

- Paracetamol

Penicillins
Propylthiouracil
Quinidine
Trimethoprim/sulphonamide

Immunological

Anti-lymphocyte globulin therapy
Neonatal isoerythrolysis
Systemic lupus erythematosus
Transfusion reactions

Infectious

Ancylostoma spp.
Babesiosis
Cyttauxzoonosis
Dirofilariasis
Ehrlichiosis
Feline leukaemia virus* (C)
Haemobartonellosis
Leishmaniasis
Leptospirosis*
Trypanosomiasis (D)
Uncinaria spp.

Neoplastic

Haemangiosarcoma
Lymphoproliferative disease, e.g.

- Leukaemia
- Lymphoma*

Mechanical injury of red cells

Dirofilariasis
Disseminated intravascular coagulation*
Enlarged spleen
Glomerulonephritis
Haemolytic–uraemic syndrome

Neoplasia causing microangiopathic haemolytic anaemia, e.g.

- Splenic haemangiosarcoma*

Patent ductus arteriosus

Vasculitis

4.2.2 Poorly/non-regenerative anaemia

Normal

Young animals

Acute, pre-regenerative anaemia

Anaemia of chronic disease/associated with systemic disease

Chronic inflammatory disease*

Chronic kidney disease* *q.v.*

Cytauxzoonosis

Feline immunodeficiency virus* (C)

Feline infectious peritonitis* (C)

Feline leukaemia virus* (C)

Hepatic disease* *q.v.*

Histoplasmosis

Hypoadrenocorticism (D)

Hypothyroidism* (D)

Leishmaniasis

Malignant neoplasia

Trypanosomiasis (D)

Bone marrow disorders – reduced red cell production

Aplastic anaemia

Drugs/toxins

- Albendazole
- Anti-cancer chemotherapeutics
- Chloramphenicol
- Cyclic hydrocarbons
- DDT
- Diazoxide
- Oestrogens
- Phenylbutazone
- Sulpha drugs

- Trichloroethylene
- Trimethoprim/sulphadiazine

Hyperoestrogenism, e.g.

- Iatrogenic
- Sertoli cell tumour

Infection

- Ehrlichiosis
- Viruses, e.g.
 - Feline leukaemia virus* (C)
 - Parvovirus*

Irradiation

Haematopoietic neoplasia

Lymphoproliferative

- Lymphoid leukaemia
 - Acute lymphoblastic leukaemia
 - Chronic lymphocytic leukaemia
- Granular lymphocytic leukaemia
- Lymphoma
- Multiple myeloma

Myeloproliferative

- Acute monocytic leukaemia
- Acute myeloid leukaemia
- Acute myelomonocytic leukaemia
- Chronic myeloid/granulocytic leukaemia

Myelodysplasia

Primary

Secondary

- Cobalamin or folate deficiencies
- Drug-induced toxicosis
- Immune-mediated diseases
- Neoplastic diseases

Myelophthisis

Granulomatous inflammation

- Fungi
- Histoplasmosis
- Tuberculosis

Myelofibrosis

- Idiopathic
- Lymphoproliferative
- Myeloproliferative
- Other types of neoplasia
- Prolonged marrow stimulation, e.g.
 - Chronic haemolytic anaemia
- Radiation

Neoplasia

- Leukaemia
- Metastatic neoplasia, e.g.
 - Carcinoma
 - Melanoma

Pure red cell aplasia

Feline leukaemia virus* (C)

Immune mediated

Defects in haemoglobin synthesis

Copper deficiency

Erythropoietic porphyria

Hereditary porphyria

Iron deficiency anaemia *q.v.*

Lead poisoning

Vitamin B6 deficiency

Defects in nucleotide synthesis**Nutrient deficiencies**

Cobalt

Folic acid

Vitamin B12

Erythropoietin deficiency

Chronic kidney disease* *q.v.*

Iron deficiency**Inadequate intake**

Dietary deficiency, e.g.

- Milk diet

Inadequate stores

Neonates*

Chronic external haemorrhage

Bleeding tumour*

Coagulopathy *q.v.*

Epistaxis *q.v.*

Haematemesis *q.v.*

Haematuria *q.v.*

Intestinal blood loss *q.v.*

Parasitism*

- *Ancylostoma* spp.
- Fleas
- Lice
- Ticks
- *Uncinaria* spp.

Rapid erythropoiesis

Erythropoietin therapy of anaemia

Neonates

Repeat phlebotomy

Blood donors*

Frequent blood sampling of small patients*

Therapeutic phlebotomy, e.g.

- Polycythaemia

Traumatic injury

Sideroblastic anaemia

4.2.3 Polycythaemia

Relative polycythaemia

*Dehydration**

Burns

Diarrhoea

Heat stroke

Polyuria without matching polydipsia

Vomiting
Water deprivation

*Splenic contraction**

Excitement
Exercise
Stress

Primary polycythaemia

Myeloproliferative disease (polycythaemia vera/primary erythrocytosis)

Secondary polycythaemia

Physiologically appropriate

Altitude
Chronic respiratory disease, e.g.

- Feline asthma*
- Interstitial fibrosis
- Neoplasia*

Haemoglobinopathies

Right-to-left congenital cardiac shunt, e.g.

- Atrial septal defect with pulmonic stenosis
- Pulmonary arteriovenous fistula
- Reverse-shunting patent ductus arteriosus
- Reverse-shunting ventricular septal defect
- Tetralogy of Fallot

Physiologically inappropriate

Extra-renal neoplasia

- Caecal leiomyosarcoma
- Hepatic carcinoma
- Hepatoblastoma
- Nasal fibrosarcoma

Hyperadrenocorticism

Hyperthyroidism* (C)

Non-neoplastic renal diseases

- Fatty infiltration of the kidney
- Hydronephrosis
- Renal capsular effusion
- Renal cysts

Renal neoplasia

- Adenocarcinoma
- Fibrosarcoma
- Lymphoma
- Nephroblastoma

Toxins, e.g.

- Carbamate

4.2.4 Thrombocytopenia

Decreased production

Bone marrow neoplasia, e.g.

- Lymphoproliferative disease
- Metastatic disease
- Myeloproliferative disease

Drugs

Albendazole

Antibiotics, e.g.

- Chloramphenicol
- Trimethoprim/sulphonamide

Chemotherapeutic/cytotoxic drugs

Chloramphenicol

Diazoxide

Griseofulvin

Methimazole

Oestrogens

Phenylbutazone

Phenytoin

Propylthiouracil

Ribavirin

Thiazide diuretics

Infection

Bacterial

- Endotoxaemia*

Fungal

- Blastomycosis
- Coccidioidomycosis

- Cryptococcosis
- Histoplasmosis

Parasitic

- Cytauxzoonosis
- Hepatozoonosis

Rickettsial

- Ehrlichiosis
- Rocky Mountain spotted fever

Viral

- Canine distemper virus* (D)
- Canine parvovirus* (D)
- Feline immunodeficiency virus* (C)
- Feline infectious enteritis* (C)
- Feline leukaemia virus* (C)

Miscellaneous

Haemophagocytic syndrome

Myelofibrosis

- Idiopathic
- Neoplasia, e.g.
 - Myeloproliferative disease
- Prolonged marrow stimulation
- Secondary to sepsis

Immune-mediated destruction

Primary immune-mediated thrombocytopenia

Concurrent immune-mediated thrombocytopenia and
immune-mediated haemolytic anaemia (Evans syndrome)

Drugs/toxins

Cephalosporins

Chlorpromazine

Colchicine

Cytotoxic drugs

Dipyrrone

Heparin

Levamisole

Methimazole

Modified live vaccines

NSAIDs

Oestrogens
Penicillins
Propylthiouracil
Quinidine
Trimethoprim/sulphonamide

Secondary immune-mediated thrombocytopenia

Infections

- Babesiosis
- Dirofilariasis
- Ehrlichiosis
- Feline immunodeficiency virus* (C)
- Feline leukaemia virus* (C)
- Leptospirosis

Neonatal alloimmune thrombocytopenia

Neoplasia, e.g.

- Lymphoma*
- Solid tumours

Systemic lupus erythematosus

Transfusion reactions

Increased utilisation/non-immune destruction

Disseminated intravascular coagulation

Haemolytic–uraemic syndrome

Microangiopathic destruction

Septicaemia

Snake venom

Chronic/severe haemorrhage

Coagulopathy

Neoplasia

Vasculitis

Canine adenovirus-1
Canine herpesvirus
Dirofilariasis
Ehrlichiosis
Feline infectious peritonitis* (C)
Neoplasia
Polyarteritis nodosa

Rocky Mountain spotted fever
Septicaemia
Systemic lupus erythematosus

Sequestration

Hepatomegaly* *q.v.*

Sepsis*

Splenomegaly* *q.v.*

- Chronic infection*
- Haematoma*
- Immune-mediated haemolytic anaemia*
- Neoplasia
 - Haemangioma
 - Haemangiosarcoma
 - Mast cell
 - Metastatic
- Portal hypertension
- Splenic torsion
- Splenitis
- Systemic lupus erythematosus

4.2.5 Thrombocytosis

Normal

May be normal in older animals

Splenic contraction

Excitement*

Exercise*

Stress*

Post splenectomy

Primary

Essential thrombocythaemia

Reactive

Bradycardia *q.v.*

Chronic haemorrhage* *q.v.*

Fractures*

Gastrointestinal disease* *q.v.*

Hyperadrenocorticism

Hypercoagulability/disseminated intravascular coagulation

Hyperviscosity syndromes

Hypotension*

Infection

Inflammation/immune-mediated disease*

Metastatic carcinoma

Non-specific bone marrow stimulation

Paraneoplastic

- Bronchoalveolar carcinoma
- Chronic myeloid leukaemia
- Gingival carcinoma
- Metastatic squamous cell carcinoma
- Osteosarcoma

Polycythaemia *q.v.*

Shock* *q.v.*

Rebound

Secondary to resolution of previous thrombocytopenia

4.2.6 Neutrophilia

Immunodeficiency syndromes, e.g.

Canine leukocyte adhesion deficiency (D)

Weimaraner immunodeficiency (D)

Inflammatory conditions – acute or chronic*, e.g.

Chemical exposure

Immune-mediated disease*, e.g.

Haemolytic anaemia*

Polyarthritis

Systemic lupus erythematosus

Infections

Bacterial*

Fungal

Protozoal

Viral*

Neoplasia

- Necrosis*
- Secondary bacterial infection*
- Ulceration*

Tissue necrosis, e.g.

- Large tumours*
- Pancreatitis*
- Pansteatitis

Toxins

- Endotoxin*
- Snakebite

Physiological

- Stress
 - Adrenaline release
 - Corticosteroid (endogenous or exogenous)

Primary

- Myeloproliferative disease
 - Acute myeloid leukaemia
 - Chronic myeloid leukaemia

Reactive

- Haemolysis* *q.v.*
- Haemorrhage*
- Neoplasia*
- Oestrogen toxicity
- Recent surgery*
- Trauma*

4.2.7 Neutropenia**Decreased neutrophil survival**

- Haemophagocytic syndromes
- Immune-mediated neutropenia (D)
- Parvovirus enteritis*

*Sepsis/endotoxaemia**, e.g.

Acute salmonellosis*

Aspiration pneumonia*

Peritonitis*

Pyometra*

Pyothorax*

Reduced neutrophil release

Trapped neutrophil syndrome in border collie (D)

Reduced neutrophil production

Canine cyclic haematopoiesis

*Acute viral infections**

Canine parvovirus* (D)

Feline immunodeficiency virus* (C)

Feline leukaemia virus* (C)

Feline panleukopenia virus* (C)

Infectious canine hepatitis* (D)

Bone marrow disease

Aplastic anaemia

- Ehrlichiosis
- Idiopathic
- Toxicity
 - Oestrogen
 - Phenylbutazone

Bone marrow neoplasia, e.g.

- Lymphoproliferative disease
- Metastatic neoplasia
- Myeloproliferative disease

Disseminated granulomatous disease

Immune-mediated destruction of neutrophil precursors

Myelodysplasia

Myelophthisis

Bone marrow suppression

Drugs

- Albendazole
- Azathioprine
- Busulphan

- Carbimazole
- Carboplatin
- Chlorambucil
- Chloramphenicol
- Cyclophosphamide
- Cytarabine
- Diazoxide
- Doxorubicin
- Frusemide
- Griseofulvin
- Hydroxyurea
- Lomustine
- Melphalan
- Methimazole
- Oestrogen
- Phenobarbitone
- Phenylbutazone
- Trimethoprim/sulphonamide (C)
- Vinblastine

Oestrogen toxicity, e.g.

- Iatrogenic
- Sertoli cell tumour

Radiation therapy

4.2.8 Lymphocytosis

Miscellaneous

Chronic infection*

Hypoadrenocorticism (D)

Recent vaccination*

Neoplasia

Leukaemia

- Acute lymphoblastic leukaemia
- Chronic lymphocytic leukaemia

Stage V lymphoma

Physiological*

Excitement*

Exercise*

Immature animal*

Post vaccination*

Stress (adrenaline response)*

4.2.9 Lymphopenia

Drugs

Albendazole

Azathioprine

Busulphan

Carbimazole

Carboplatin

Chlorambucil

Chloramphenicol

Corticosteroids

Cyclophosphamide

Cyclosporin

Cytarabine

Diazoxide

Doxorubicin

Frusemide

Griseofulvin

Hydroxyurea

Lomustine

Melphalan

Phenylbutazone

Trimethoprim/sulphonamide (C)

Vinblastine

Endocrine

Hyperadrenocorticism

Immunodeficiency syndromes, e.g.

Basset hound

Cardigan Welsh corgi

Jack Russell terrier

Infectious/inflammatory

Septicaemia*

Viral infections, e.g.

- Canine distemper virus* (D)
- Coronavirus*
- Feline immunodeficiency virus* (C)
- Feline leukaemia virus* (C)
- Infectious canine hepatitis* (D)
- Parvovirus

Loss of lymph

- Chylothorax
- Lymphangiectasia
- Protein-losing enteropathy* *q.v.*

Physiological

- Stress (corticosteroid response)*

4.2.10 Monocytosis

Chronic inflammation

- Granulomatous inflammation
- Pyogranulomatous inflammation
- Suppuration*
- Tissue necrosis*

Corticosteroids

- Hyperadrenocorticism
- Iatrogenic
- Stress

Infections

Fungal, e.g.

- Coccidioidomycosis

Parasitic, e.g.

- Leishmaniasis

Viral, e.g.

- Feline immunodeficiency virus* (C)

Bacterial e.g.
Rickettsial

Haemolytic/haemorrhagic diseases* q.v.

Immune-mediated disease, e.g.

Immune-mediated haemolytic anaemia*
Immune-mediated polyarthritis

Neoplasia

Monocytic leukaemia
Myelomonocytic leukaemia
Tumours with necrotic centres*

4.2.11 Eosinophilia

Hormonal

Hypoadrenocorticism
Oestrus in some bitches

Immune mediated

Allergies *

- Atopy*
- Feline asthma* (C)
- Flea allergy*
- Food allergies*

Canine panosteitis (D)
Eosinophilic bronchopneumopathy (D)
Eosinophilic gastroenteritis*
Eosinophilic granuloma complex*
Eosinophilic myositis
Feline hypereosinophilic syndrome (C)
Pemphigus foliaceus

Infection

*Bacterial**

Fungal, e.g.
Aspergillosis
Cryptococcosis

Parasites*, e.g.

Aelurostrongylus abstrusus
Ancylostoma spp.
Angiostrongylus vasorum
Capillaria aerophila
Dirofilaria immitis
Oslerus osleri
Pneumonyssoides caninum
Trichuris vulpis

Neoplastic

Eosinophilic leukaemia

Tumour-associated eosinophilia

Fibrosarcoma
Myeloproliferative disease
Lymphoma
Mast cell tumour
Mucinous carcinomas
Transitional cell carcinoma

4.2.12 Eosinopenia

Acute infection*
Acute inflammation*
Bone marrow aplasia/hypoplasia
Glucocorticoid therapy*
Hyperadrenocorticism
Stress*

4.2.13 Mastocyturia

Disseminated mast cell neoplasia
Mast cell leukaemia
Mast cell tumour*, e.g.

- Intestinal tract
- Spleen

Severe inflammation

4.2.14 Basophilia

Chronic granulocytic leukaemia
Hyperlipoproteinaemia
Hypersensitivity reactions
Lymphoma
Lymphomatoid granulomatosis
Lymphoplasmacytic gastroenteritis
Mast cell tumours*
Parasitism, especially dirofilariasis

4.2.15 Increased buccal mucosal bleeding time (disorders of primary haemostasis)

Thrombocytopenia q.v.

Thrombocytopathia

Acquired

Chronic anaemia
Disseminated intravascular coagulation
Drugs/toxins

- Antibiotics
- Barbiturates
- Calcium channel blockers
- Colloids
- Heparin
- Hetastarch
- NSAIDs, especially aspirin
- Propranolol
- Theophylline
- Snake venom

Hepatic disease*

Infection

- Ehrlichiosis
- Feline leukaemia virus* (C)

Neoplasia*, e.g.

- Lymphocytic leukaemia
- Multiple myeloma

Paraproteinaemias

- Benign macroglobulinaemia
- Polyclonal gammopathies

Uraemia* *q.v.*

Inherited

Basset hound thrombopathia (D)

Canine thrombasthenic thrombopathia of otter hounds
and great pyrenees (D)

Chédiak–Higashi syndrome (C)

Cocker spaniel bleeding disorders (D)

Cyclic haematopoiesis (grey collie)

Glanzmann's thrombasthenia (D)

von Willebrand's disease* (D)

4.2.16 Increased prothrombin time (disorders of extrinsic and common pathways)

Artefact

Deficiency of factor II, V, VII or X

Disseminated intravascular coagulation

Hypo- or dysfibrinogenaemia

Liver disease*, e.g.

- Portosystemic shunt
- Vitamin K antagonism*

4.2.17 Increased partial thromboplastin time or activated clotting time (disorders of intrinsic and common pathways)

Colloid administration

Disseminated intravascular coagulation

Factor II, V, X, XI or XII deficiency

Haemophilia A (factor VIII deficiency)

Haemophilia B (factor IX deficiency)

Haemorrhage

Hypo- or dysfibrinogenaemia

Liver disease* *q.v.*

Vitamin K antagonism*

Vitamin K-dependent coagulopathy

4.2.18 Increased fibrin degradation products

Disseminated intravascular coagulation

Hepatic disease* *q.v.*

Hyperfibrinogenolysis

Internal haemorrhage

Thrombosis*

Vitamin K antagonism*

4.2.19 Decreased fibrinogen levels

Artefact

- Clot
- Incorrect anticoagulant

Disseminated intravascular coagulation*

Excessive blood loss*

Hereditary fibrinogen deficiency

Immune-mediated haemolytic anaemia

Severe hepatic deficiency

4.2.20 Decreased antithrombin III levels

Heparin therapy

Hepatic disease* *q.v.*

Hypercoagulability, e.g.

- Disseminated intravascular coagulation

Protein-losing enteropathy* *q.v.*, e.g.

- Parvovirus enteritis

Protein-losing nephropathy* *q.v.*

4.3 Electrolyte and blood gas findings

4.3.1 Total calcium

Decreased

- Acute pancreatitis*
- Acute kidney injury *q.v.*
- Canine distemper virus* (D)
- Chronic kidney disease* *q.v.*
- Exocrine pancreatic insufficiency (D)
- Hypoalbuminaemia* *q.v.*
- Hypomagnesaemia *q.v.*
- Hipoproteinaemia
- Hypovitaminosis D
- Iatrogenic (post thyroidectomy)*
- Idiopathic
- Infarction of parathyroid gland adenomas
- Intestinal malabsorption*
- Lactational hypocalcaemia
- Medullary carcinoma of the thyroid (C-cell tumour)
- Nutritional secondary hyperparathyroidism
- Primary hypoparathyroidism
- Puerperal tetany (eclampsia)*
- Rhabdomyolysis
- Tumour lysis syndrome

Artifact

- Haemolysis
- Incorrect anticoagulant

Drugs/toxins

- Anticonvulsants
- Calcitonin therapy
- EDTA
- Ethylene glycol
- Furosemide
- Glucagon
- Intravenous phosphate administration

Mithramycin
Oxalate toxicity
Pamidronate
Phosphate-containing enemas
Sodium bicarbonate
Transfusion using citrated blood

Increased

Acute kidney injury *q.v.*
Artefact

- Lipaemia

Chronic kidney disease* *q.v.*
Dehydration/hyperalbuminaemia* *q.v.*
Granulomatous disease
Hypervitaminosis A
Hypervitaminosis D
Hypoadrenocorticism (D)
Idiopathic hypercalcaemia of cats (C)
Physiological

- Postprandial
- Young dog*

Tertiary hyperparathyroidism

Drugs/toxins

Anabolic steroids
Calcipotriol
Cholecalciferol rodenticides
Hydralazine
Jasmine
Oestrogen
Oral or intravenous calcium
Oral phosphate binders
Paracetamol
Parenteral calcium administration
Progesterone
Testosterone
Trilostane
Vitamin D analogues

Hypercalcaemia of malignancy

Carcinoma

- Bronchogenic
- Mammary
- Nasal cavity
- Prostatic
- Squamous cell
- Thyroid

Haematological malignancies

- Lymphoma*
- Multiple myeloma
- Myeloproliferative disease

Metastatic or primary bone neoplasia *q.v.*

Pseudohyperparathyroidism

- Apocrine gland adenocarcinoma*
- Lymphoma*

Primary hyperparathyroidism

Hereditary neonatal hyperparathyroidism

Multiple endocrine neoplasia

Parathyroid gland adenoma

Parathyroid gland carcinoma

Primary hyperplasia of the parathyroid glands

Skeletal lesions

Bone metastases

Hypertrophic osteodystrophy

Osteomyelitis

Systemic mycoses

4.3.2 Chloride

Note: Most causes of hyperchloraemia also cause concurrent hypernatraemia, and if changes are proportionate, it is usually easier to look for causes of hypernatraemia. Formulae to correct chloride to account for sodium changes have been suggested as follows:

Dogs: $\text{Cl}^- \text{ (corrected)} = \text{Cl}^- \text{ (measured)} \times [146 / \text{Na}^+ \text{ (measured)}]$

Reference ranges: $\text{Cl}^- \text{ (measured)} = 100 - 116 \text{ mmol/l}$

$\text{Cl}^- \text{ (corrected)} = 107 - 113 \text{ mmol/l}$

Cats: $\text{Cl}^- \text{ (corrected)} = \text{Cl}^- \text{ (measured)} \times [156 / \text{Na}^+ \text{ (measured)}]$

Reference ranges: $\text{Cl}^- \text{ (measured)} = 100 - 124 \text{ mmol/l}$

$\text{Cl}^- \text{ (corrected)} = 117 - 123 \text{ mmol/l}$

Note: Reference ranges may vary depending on the instruments used to perform the measurement.

Decreased

Artefact

Lipaemia

Corrected hypochloraemia

Chronic respiratory acidosis *q.v.*

Exercise*

Hyperadrenocorticism

Vomiting*

Drugs

- Frusemide
- Sodium bicarbonate
- Thiazide diuretics

Increased

Artefact

Hypotonic water loss

Lipaemia

Potassium bromide therapy

Pure water loss

Corrected hyperchloraemia

Chronic respiratory alkalosis *q.v.*

Diabetes mellitus*

Drugs/toxins

- Acetazolamide
- Fluid therapy with saline

- Potassium chloride supplementation
- Salt poisoning
- Spironolactone
- Total parenteral nutrition
- Urinary acidifiers, e.g. ammonium chloride

Fanconi syndrome

Hyperaldosteronism

Hypoaldrenocorticism (D)

Renal disease* *q.v.*

Renal tubular acidosis

Small intestinal diarrhoea*

4.3.3 Magnesium

Decreased

Acute pancreatitis*

Cholestasis* *q.v.*

Decreased intake

Hypercalcaemia *q.v.*

Hypokalaemia *q.v.*

Artifact

Haemolysis

Drugs/iatrogenic

Amino acids

Aminoglycosides

Blood transfusion

Cisplatin

Digitalis

Diuretics, e.g.

- Furosemide

- Thiazides

Haemodialysis

Insulin

Nasogastric suction

Pamidronate

Peritoneal dialysis

Prolonged intravenous fluid therapy
Total parenteral nutrition

Endocrine

Diabetic ketoacidosis*
Hyperthyroidism* (C)
Hypoparathyroidism (ionised hypomagnesaemia)
Primary hyperaldosteronism
Primary hyperparathyroidism

Intestinal loss

Bowel resection
Enteropathies*

Redistribution

Hypothermia* *q.v.*
Sepsis*
Trauma*

Renal

Acute tubular necrosis
Drug-induced tubular injury

- Aminoglycosides
- Cisplatin

Post-obstructive diuresis*

Increased

Artefact

- Sample haemolysis

Drugs

- Oral antacids
- Parenteral administration
- Progestones

Haemolysis
Hypoadrenocorticism (D)
Obstructive uropathy*
Renal disease* *q.v.*
Thoracic neoplasia/pleural effusion (C)

4.3.4 Potassium

Decreased

Diet

Decreased dietary intake
High-protein acidifying diets

Drugs/iatrogenic

Albuterol
Amphotericin B
Catecholamines
Dialysis
Diuretics, e.g.

- Frusemide
- Mineralocorticoids
- Penicillins
- Thiazides

Fludrocortisone

Frusemide

Glucose

Hydrochlorothiazide

Inadequate potassium supplementation during fluid therapy

Insulin

Terbutaline

Total parenteral nutrition

Endocrine

Diabetes mellitus*
Hyperadrenocorticism
Mineralocorticoid excess
Primary hyperaldosteronism

Increased loss

Chronic kidney disease* *q.v.*

Diuresis, e.g.

- Diabetes mellitus*
- Diuretic therapy

Gastrointestinal loss (vomiting, diarrhoea)* *q.v.*

Post-obstructive diuresis*

Renal tubular acidosis

Translocation

Alkalosis

Hypothermia* *q.v.*

Idiopathic hypokalaemia of Burmese cats (C)

Increased

Artefact/pseudohyperkalaemia

Contamination of sample with potassium EDTA

Haemolysis (especially Japanese Akita)

Marked leukocytosis/thrombocytosis with delay
in separating serum

Thrombocytosis

Decreased urinary excretion

Acute kidney injury *q.v.*

Repeated drainage of effusions, e.g. chylothorax

Gastrointestinal diseases*

- Perforated duodenal ulcer
- Salmonellosis
- Trichuriasis

Hyporeninaemic hypoaldosteronism

Post-renal failure* *q.v.*

Ruptured bladder/uropertitoneum

Hypoadrenocorticism (D)

Drugs/toxins

ACE inhibitors

Amiloride

Beta blockers

Cardiac glycosides

Ethylene glycol

NSAIDs

Oral or parenteral potassium supplementation

Paraquat

Prostaglandin inhibitors

Salbutamol

Spironolactone

Succinylcholine
Tricyclic antidepressants
Trilostane

Increased intake

Iatrogenic

Translocation

Acidosis *q.v.*
Diabetes mellitus/diabetic ketoacidosis*
Reperfusion injury, e.g.

- Aortic thromboembolism
- Crush

Tumour lysis syndrome

4.3.5 Phosphate

Decreased

Decreased dietary intake
Decreased intestinal absorption
Diarrhoea* *q.v.*
Eclampsia*
Hypercalcaemia of malignancy*
Hypothermia* *q.v.*
Hypovitaminosis D
Increased urinary excretion*
Metabolic acidosis* *q.v.*
Renal tubular defects, e.g.

- Fanconi syndrome

Respiratory alkalosis *q.v.*
Vomiting* *q.v.*

Drugs/iatrogenic

Bicarbonate
Diuretics
Fluid therapy
Glucocorticoids
Glucose
Insulin

Pamidronate
Phosphate-binding antacids
Salicylates
Vitamin D deficiency

Endocrine disorders

Diabetic ketoacidosis*
Hyperadrenocorticism
Hyperinsulinism/insulinoma
Primary hyperparathyroidism

Increased

Acute kidney injury or chronic kidney disease* *q.v.*
Haemolysis* *q.v.*
Metabolic acidosis* *q.v.*
Muscle trauma/necrosis*
Normal juvenile animal
Osteolytic bone lesions
Pre-renal azotaemia* *q.v.*
Post-renal azotaemia *q.v.*
Tumour lysis syndrome

Artifact

Haemolysis

Drugs/toxins

Cholecalciferol rodenticides
Hypervitaminosis D
Jasmine toxicity
Phosphate-containing enemas
Phosphate supplementation

Endocrine disorders

Acromegaly
Hyperthyroidism* (C)
Nutritional secondary hyperparathyroidism
Primary hypoparathyroidism
Renal secondary hyperparathyroidism*

4.3.6 Sodium

Decreased

Congestive heart failure with effusion*

Diarrhoea*

Hyperglycaemia* *q.v.*

Hyperlipidaemia *q.v.*

Hypoadrenocorticism (D)

Inappropriate antidiuretic hormone secretion

Inappropriate fluid therapy

Liver disease with ascites* *q.v.*

Marked hyperproteinæmia *q.v.*

Myxoedema coma of hypothyroidism

Nephrotic syndrome with effusion

Over-hydration

Pancreatitis*

Psychogenic polydipsia*

Renal disease* *q.v.*

Vomiting* *q.v.*

Dehydration/hypovolaæmia

Cutaneous loss, e.g.

- Burns

Gastrointestinal loss*

Hypoadrenocorticism (D)

Drugs

Cyclophosphamide

Diuretics, e.g.

- Amiloride
- Frusemide
- Mannitol
- Spironolactone
- Thiazides

NSAIDs

Vincristine

Effusions

Peritonitis*

Pleural effusion* *q.v.*

Uroabdomen

Third space loss

Chylothorax with repeated drainage

Pancreatitis*

Peritonitis*

Uroabdomen

Increased

Drugs/toxins

Fludrocortisone

Hypertonic saline

Salt-containing products, e.g.

- Playdough

Sodium bicarbonate

Sodium phosphate enemas

Hypotonic fluid loss

Cutaneous, e.g.

- Burns

Diabetes mellitus (secondary to osmotic diuresis)*

Gastrointestinal (vomiting, diarrhoea, small intestinal obstruction)* *q.v.*

Post-obstructive diuresis*

Renal disease* *q.v.*

Third space loss, e.g.

- Pancreatitis*

- Peritonitis*

Increased intake

Hyperadrenocorticism

Hyperaldosteronism

Iatrogenic

Salt poisoning

Pure water loss

Hypodipsia or adipsia, e.g.

- Cranial trauma

- Diabetes insipidus

- Inflammatory brain disease
- Intracranial neoplasia

Hyperthermia *q.v.*

Lack of free access to water with normal or increased insensible losses

Panting/hyperventilation

Severe exercise in greyhounds

4.3.7 pH

ACIDAEMIA

Metabolic acidosis

Diabetic ketoacidosis*

Hypoadrenocorticism (D)

Post-hypocapnic metabolic acidosis

Renal disease* *q.v.*

Renal tubular acidosis

Drugs/toxins

Acetazolamide

Ammonium chloride

Ethylene glycol

Methanol

Methionine

Paraldehyde

Salicylic acid

Lactic acid production

Diarrhoea* *q.v.*

Hypoxaemia

Pancreatitis*

Sepsis*

Shock* *q.v.*

Respiratory acidosis

Cardiopulmonary arrest

CNS disease (*brainstem/high cervical spinal lesion*), e.g.

Intracranial space-occupying lesion

Trauma

Iatrogenic respiratory depression

Anaesthesia
Opiates
Organophosphates
Pancuronium
Succinylcholine

Neuromuscular defects

Botulism
Idiopathic hypokalaemia of Burmese cats (C)
Myasthenia gravis
Polymyositis
Polyradiculoneuritis
Tetanus
Tick paralysis

Severe respiratory disease

Acute respiratory distress syndrome
Airway obstruction*
Aspiration pneumonia
Chest wall trauma
Diaphragmatic hernia*
Haemothorax*
Neoplasia*
Pleural effusion* *q.v.*
Pneumonia* *q.v.*
Pneumothorax* *q.v.*
Pulmonary fibrosis
Pulmonary oedema* *q.v.*
Pulmonary thromboembolism
Pyothorax*
Smoke inhalation

ALKALAEMIA**Metabolic alkalosis**

Hyperadrenocorticism
Post hypercapnia
Primary hyperaldosteronism
Vomiting*

Drugs

Acetate
Bicarbonate
Citrate
Diuretics
Exogenous steroid therapy
Gluconate
Lactate

Respiratory alkalosis

Overzealous ventilator therapy

Direct stimulation of medullary respiratory centre (neurogenic hyperventilation)

CNS disease *q.v.*
Hepatic disease *q.v.*
Sepsis*
Drugs

- Methyl xanthines
- Salicylate intoxication

Hypoxaemia, e.g.

Congestive heart failure*
High altitude
Pulmonary disease*
Right-to-left cardiac shunts
Severe anaemia* *q.v.*

Panting/hyperventilation

Anxiety*
Fever*
Heat stroke*
Hyperthyroidism* (C)
Pain*

4.3.8 paO₂**Decreased**

CNS disease (brainstem/high cervical spinal lesion), e.g.

Intracranial space-occupying lesion
Trauma

Heart disease

- Pulmonary oedema* *q.v.*
- Right-to-left shunting

Iatrogenic respiratory depression

- Anaesthesia
- Opiates
- Organophosphates
- Pancuronium
- Succinylcholine

Inadequate oxygen in inspired air

- Failure of oxygen supply during anaesthesia
- High altitude

Neuromuscular defects

- Botulism
- Idiopathic hypokalaemia of Burmese cats (C)
- Myasthenia gravis
- Polymyositis
- Polyradiculoneuritis
- Tetanus
- Tick paralysis

Severe respiratory disease

- Acute respiratory distress syndrome
- Airway obstruction*
- Aspiration pneumonia*
- Chest wall trauma*
- Diaphragmatic hernia*
- Haemothorax*
- Neoplasia*
- Pleural effusion* *q.v.*
- Pneumonia* *q.v.*
- Pneumothorax* *q.v.*
- Pulmonary fibrosis
- Pulmonary oedema* *q.v.*
- Pulmonary thromboembolism
- Pyothorax*
- Smoke inhalation

Increased

Oxygen supplementation

4.3.9 Total CO₂**Decreased**

Respiratory alkalosis *q.v.*

Increased

Respiratory acidosis *q.v.*

4.3.10 Bicarbonate**Decreased**

Metabolic acidosis *q.v.*

Increased

Metabolic alkalosis *q.v.*

4.3.11 Base excess**Decreased**

Metabolic acidosis *q.v.*

Increased

Metabolic alkalosis *q.v.*

4.4 Urinalysis findings**4.4.1 Alterations in specific gravity****HYPOSTHENURIA****Increased water loss but no increased loss of solutes****Drugs**

Anticonvulsants

Carbonic anhydrase inhibitors

Corticosteroids
Frusemide
Spironolactone
Thiazide diuretics

Polyuria due to decreased ADH secretion

Drugs, e.g.

- Adrenaline
- Phenytoin

Insulinoma

Over-hydration

Pheochromocytoma

Primary central diabetes insipidus

Psychogenic polydipsia*

Polyuria due to ADH inhibition/resistance

Hyperadrenocorticism

Hypercalcaemia* q.v.

Hyperthyroidism* (C)

Hypokalaemia* q.v.

Liver disease* q.v.

Primary hyperparathyroidism

Primary nephrogenic diabetes insipidus

Toxaemia, e.g.

- Pyometra*

Inability of kidneys to concentrate urine

Acute kidney injury q.v.

Chronic kidney disease* q.v.

Hypoadrenocorticism (loss of medullary concentrating gradient)

Pyelonephritis

HYPERTHENURIA

Polyuria with excess solute loss

Acromegaly

Diabetes mellitus*

Diet

- High protein
- High salt

Fanconi syndrome
Hyperviscosity
Osmotic diuretics

- Dextrose
- Mannitol

Primary renal glucosuria

Decreased loss of water and no decreased loss of solutes

Cardiac failure*
Dehydration*
Haemorrhage*
Renal infarction
Shock* *q.v.*

4.4.2 Abnormalities in urine chemistry

Bilirubin

False positive, e.g. pigmenturia
Fever* *q.v.*
Haemolytic disease
Hyperbilirubinaemia* *q.v.*
Normal in small quantities in dogs*
Starvation*

Blood

See Haematuria *q.v.*

Glucose

Hyperglycaemia q.v.
Diabetes mellitus*
Hyperadrenocorticism
Iatrogenic
Pheochromocytoma
Primary hyperaldosteronism
Stress*

Renal tubular disorders

Fanconi syndrome
Primary renal glucosuria

Urinary tract haemorrhage with mild hyperglycaemia

Haemoglobin

Haematuria *q.v.*

Haemolysis q.v.

Disseminated intravascular coagulation

Haemoplasmosis

Immune-mediated haemolytic anaemia*

Incompatible blood transfusion

Microangiopathic anaemia

Neonatal isoerythrolysis

Physical causes

- Burns
- Intravenous hypotonic solutions
- Radiation

Splenic torsion

Toxins

- Benzocaine
- Chlorate
- Dimethyl sulphoxide
- Nitrate
- Paracetamol
- Propylthiouracil
- Snake venom

Ketones

Hypoglycaemia, e.g.

- Insulinoma *q.v.*

Low-carbohydrate, high-fat diet

Starvation

Uncontrolled diabetes mellitus/diabetic ketoacidosis*

Myoglobin – muscle injury/necrosis

Athletic performance

Exercise-induced rhabdomyolysis

Heat stroke*

Ischaemia, e.g.

- Aortic thromboembolism*

Trauma

- Crush injury*

Toxins

- Snakebites

Nitrite

(Note: There are many false negatives in dogs and cats.)

Gram-negative bacteriuria

Protein

False positives (strip test)

Contamination, e.g.

- Benzalkonium chloride
- Cetrimide
- Chlorhexidine

Stale urine

False positives (20% sulphosalicylic acid test)

Cephalosporins

Penicillins

Radiographic contrast media

Sulphafurazole

Thymol

Tolbutamide

Pre-renal

Haemoglobinuria, e.g.

- Haemolytic anaemia*

Hyperproteinaemia *q.v.*

Myoglobinuria, e.g.

- Muscle trauma*
- Rhabdomyolysis

Physiological, e.g.

- Exercise*
- Stress*

Renal

Mild to moderate

- Acute kidney injury *q.v.*
- Amyloidosis

- Breed-associated nephropathy (D)
- Chronic kidney disease* *q.v.*
- Fanconi syndrome
- Glomerulonephritis
- IgA nephropathy
- Primary renal glucosuria
- Secondary glomerular disease
 - Bacterial endocarditis
 - Borreliosis
 - Brucellosis
 - Chronic bacterial infection*
 - Chronic skin disease* *q.v.*
 - Diabetic glomerulosclerosis
 - Dirofilariasis
 - Ehrlachiosis
 - Feline infectious peritonitis* (C)
 - Feline leukaemia virus* (C)
 - Hyperthermia* *q.v.*
 - Hypothermia* *q.v.*
 - Immune-mediated haemolytic anaemia*
 - Infectious canine hepatitis* (D)
 - Inflammatory bowel disease*
 - Leishmaniasis
 - Leptospirosis*
 - Mycoplasma polyarthritis
 - Pancreatitis*
 - Polyarthritis
 - Prostatitis*
 - Pyometra*
 - Pyrexia* *q.v.*
 - Rocky Mountain spotted fever (D)
 - Septicaemia*
 - Sulphonamide hypersensitivity
 - Systemic lupus erythematosus

Severe

- Amyloidosis
- Glomerulonephritis

Post-renal

Genital tract inflammation

- Prostatitis*
- Vaginitis*

Genital tract secretions

Urinary tract inflammation

- Trauma*
- Urinary tract infection*
- Urolithiasis*

Urogenital neoplasia

- Bladder neoplasia
- Ureteral neoplasia
- Urethral neoplasia
- Vaginal or prostatic neoplasia

pH**DECREASED (<7)**

Acidifying diets*

Drugs

- Ammonium chloride
- Frusemide
- Methionine
- Sodium acid phosphate
- Sodium chloride

Metabolic acidosis* *q.v.*

Respiratory acidosis* *q.v.*

INCREASED

Artefact

- Contamination with ammonia and detergents
- Old sample

Diet

- Low protein*
- Postprandial alkaline tide*

Drugs

- Acetazolamide
- Chlorothiazides
- Potassium citrate

- Sodium bicarbonate
- Sodium lactate

Metabolic alkalosis *q.v.*

Urinary tract disease

- Proximal renal tubular acidosis
- Urinary retention*
- Urinary tract infection with urea-producing bacteria*

Urobilinogen

(Note: Of limited use in veterinary medicine)

Re-establishment of bile flow after an episode of biliary obstruction

4.4.3 Abnormalities in urine sediment

Casts

Bilirubin

- Bilirubinuria

Broad casts

- Chronic pyelonephritis
- Dilated renal tubules

Epithelial cell, fatty, granular and waxy casts

- Acute kidney injury *q.v.*
- Chronic kidney disease* *q.v.*
- Degeneration/necrosis of tubular epithelial cells
- Degeneration of white cells
- Glomerulopathy

Haemoglobin

- Haemoglobinuria *q.v.*

Hyaline

- Associated with proteinuria *q.v.*

Myoglobin

- Myoglobinuria *q.v.*

Red blood cell

- Renal tubular haemorrhage

White cell

- Tubulointerstitial inflammation

Crystals (predisposing factors)

Bilirubin

(See Bilirubinuria and Hyperbilirubinaemia)

Calcium oxalate

Diet

- Excess calcium
- Excess oxalic acid
- Excess vitamin C
- Excess vitamin D

Ethylene glycol poisoning

Hyperadrenocorticism

Hypercalciuria

- Hypercalcaemia *q.v.*

Calcium phosphate

Alkaline urine

Primary hyperparathyroidism

Renal tubular acidosis

Cystine

Acid pH

Inherited defect of renal tubular cells

Silica

Dietary

- Gluten
- Soya bean hulls

Soil ingestion

Struvite

Alkaline urine*

Urinary bladder foreign body

Urinary tract infection*

Urate

Acid urine

Breed associated

- Dalmatian*
- English bulldog

Portosystemic shunts

Urinary tract infection*

Xanthine

Allopurinol administration
Hereditary

Increased red blood cells

Haematuria *q.v.*

Increased white blood cells

Low numbers – normal
Neoplasia
Urinary tract infection*
Urinary tract inflammation*
Urolithiasis*

4.4.4 Infectious agents

Bacteria

Contamination*

- Catheterised sample*
- Failure of sterile collection technique
- Voided sample*

Urinary tract infection*

Fungi

Blastomycosis
Candidiasis
Contaminants*
Cryptococcosis
Prolonged antibiotic therapy

Parasites

Capillaria ova
Dioctophyma renale ova
Dirofilaria microfilaria
Faecal contamination*

Predisposing factors to urinary tract infection*Alteration of urothelium*

Changes in normal flora of distal urogenital tract

Drugs

- Cyclophosphamide
- Oestrogens

Metaplasia

- Oestrogens
 - Exogenous
 - Sertoli cell tumours*

Neoplasia*

Trauma

- External*
- Iatrogenic, e.g.
 - Catheterisation*
 - Palpation
 - Surgery*
- Urolithiasis*

Alterations in urine

Decreased frequency of urination

- Involuntary retention*
- Voluntary retention*

Decreased volume

- Decreased water consumption*
- Increased fluid loss*
- Oliguric/anuric kidney injury *q.u.*

Dilute urine*

Glucosuria*

Anatomic defects

Acquired

- Chronic lower urinary tract disease*
- Secondary vesicoureteral reflux
- Surgical procedures

Congenital

- Ectopic ureters
- Persistent urachal diverticula
- Primary vesicoureteral reflux
- Urethral

Immunodeficiency

Congenital diseases

Hyperadrenocorticism

Iatrogenic, e.g.

- Corticosteroids*

Uraemia* *q.v.*

Interference with normal micturition

Outflow obstruction

- Neoplasia*
- Prostatic disease*
- Strictures
- Urinary bladder herniation
- Urolithiasis*

Incomplete emptying of bladder

- Anatomic defects
 - Diverticula
 - Vesicoureteral reflux
- Neurogenic
 - Reflex dyssynergia*
 - Spinal disease

4.5 Cytological findings

4.5.1 Tracheal/bronchoalveolar lavage

Increased neutrophils

Aspiration pneumonia*

Bacterial bronchitis*

Bronchopneumonia*

Canine tracheobronchitis* (D)

Chronic bronchitis*

Foreign body*

Parasites, e.g.

- *Angiostrongylus vasorum*

Increased eosinophils

Drugs

- Potassium bromide (C)

Eosinophilic bronchitis*

Feline asthma* (C)

Parasites

- *Aelurostrongylus abstrusus*
- *Angiostrongylus vasorum*
- *Capillaria aerophila*
- *Crenosoma vulpis*
- *Oslerus* spp.

Pulmonary infiltrate with eosinophils/eosinophilic bronchopneumopathy

Organisms visible on microscopy/detectable on culture

Upper respiratory tract

Aelurostrongylus abstrusus
Bordetella bronchiseptica
Capillaria aerophila
Malassezia pachydermatis
Mycobacteria spp.
Mycoplasma spp.
Oslerus osleri

Lower respiratory tract

Aelurostrongylus abstrusus
Aspergillus spp.
Blastomyces dermatitidis
*Bordetella bronchiseptica**
Capillaria aerophila
Coccidioides immitis
Crenosoma vulpis (D)
Cryptococcus neoformans
Eucoleus aerophilus
Haemophilus felis
Histoplasma capsulatum
Mycobacteria spp.
Mycoplasma spp.
Opportunistic bacteria*

- *Pasteurella* spp.
- *Pseudomonas* spp.
- *Salmonella* Typhimurium

Oslerus spp.

Paragonimus kellicotti (D)

Penicillium spp.

Pneumocystis carinii (D)

Toxocara canis

Toxoplasma gondii

Yersinia pestis

4.5.2 Nasal flush cytology

Inflammation

Acute or chronic inflammation secondary to foreign body or dental disease*

Allergic rhinitis*

Granulomatous rhinitis

Lymphoplasmacytic rhinitis*

Nasopharyngeal polyp*

Oronasal fistula

Neoplasia

Adenocarcinoma*

Chondrosarcoma

Esthesioneuroblastoma

Fibrosarcoma

Haemangiosarcoma

Histiocytoma

Leiomyosarcoma

Liposarcoma

Lymphoma*

Malignant fibrous histiocytoma

Malignant melanoma

Malignant nerve sheath tumour

Mast cell tumour

Myxosarcoma

Neuroendocrine tumour

Osteosarcoma

Paranasal meningioma

Rhabdomyosarcoma

Squamous cell carcinoma*

Transitional cell carcinoma

Transmissible venereal tumour
Undifferentiated carcinoma*
Undifferentiated sarcoma

Organisms visible on microscopy/detectable on culture

Bacterial/mycoplasmal disease
*Bordetella bronchiseptica**
*Chlamydophila felis** (C)
Haemophilus felis
Mycoplasma spp.*

Fungal disease
Aspergillosis
Cryptococcosis
Penicillium spp.
Rhinosporidium spp.

Parasites
Capillaria aerophila
Cuterebra spp.
Eucoleus böehmi
Linguatula serrata
Pneumonyssoides caninum (D)

4.5.3 Liver cytology

Note that cytology of the liver often has low diagnostic value.

Amyloidosis

Hyperplasia
Nodular hyperplasia*

Increased bile pigment

Cholestasis* *q.v.*

Increased copper

Copper-associated hepatopathy

Infectious hepatopathies

Babesiosis
Bacillus piliformis

Bacterial cholangiohepatitis*
Canine adenovirus-1* (D)
Canine herpesvirus (D)
Capillaria hepatica
Cyttauxzoonosis
Ehrlichiosis
Extrahepatic sepsis
Feline coronavirus* (C)
Hepatozoon canis
Leishmaniasis
Leptospirosis*
Liver abscess
Metorchis conjunctus
Mycobacteriosis
Neosporosis
Opisthorchis felineus
Rhodococcus equi
Toxoplasmosis
Yersiniosis

Inflammatory hepatopathies

Cholangiohepatitis* *q.v.*
Chronic hepatitis* *q.v.*
Copper retention/storage disease
Drugs

- Anticonvulsants
- NSAIDs

Granulomatous hepatitis

- *Bartonella henselae*
- Fungal disease
- Intestinal lymphangitis/lymphangiectasia
- Leishmaniasis

Idiosyncratic drug reaction
Lobular dissecting hepatitis

Neoplastic cells, e.g.

Bile duct carcinoma
Haemangiosarcoma
Hepatocellular adenocarcinoma*
Leiomyosarcoma

Lymphoma*

Mast cell

Metastatic tumour*

Vacuolar hepatopathies

Chronic infections, e.g.

- Dental disease*
- Pyelonephritis

Diabetes mellitus*

Exogenous glucocorticoid administration*

Hyperadrenocorticism

Hyperlipidaemia

Hypothyroidism* (D)

Inflammatory bowel disease*

Lipid storage disease

Neoplasia*

Pancreatitis*

4.5.4 Kidney cytology

Note that cytology of the kidney often has low diagnostic value.

Inflammatory cells

Chronic interstitial nephritis*

Glomerulonephritis

Leptospirosis*

Neoplasia

Pyelonephritis

Renal abscess

Neoplastic cells

Adenocarcinoma

Chondrosarcoma

Haemangioma

Haemangiosarcoma

Lymphoma*

Metastatic thyroid adenocarcinoma

Osteosarcoma

4.5.5 Skin scrapes/hair plucks/tape impressions

Fungi

Dermatophytosis

Malassezia spp.

Parasites

Cheyletiella spp.*

Demodex spp.*

Felicola subrostratus

Heterodoxus spiniger

Larval ticks*

*Linognathus setosus**

Lynxacarus radovskyi

Notoedres cati

*Otodectes cynotis**

*Sarcoptes scabiei** (D)

Trichodectes canis

Trombiculid mites*

4.5.6 Cerebrospinal fluid (CSF) analysis

RAISED CSF WHITE CELL COUNT AND/OR PROTEIN LEVELS

Infectious

Algal

Protothecosis

Bacterial

Leptospirosis

Various aerobes and anaerobes, e.g.

- *Escherichia coli*
- *Klebsiella* spp.
- *Streptococcus* spp.

Fungal

Aspergillosis
Blastomycosis
Coccidioidomycosis
Cryptococcosis
Histoplasmosis
Hyalohyphomycosis
Phaeohyphomycosis

Parasitic

Ancylostoma caninum
Angiostrongylus cantonensis
Cuterebra spp.
Dirofilaria immitis
Toxocara canis

Protozoal

Acanthamoebiasis
Babesiosis
Encephalitozoonosis
Neosporosis
Sarcocystis-like organism
Toxoplasmosis
Trypanosomiasis

Rickettsial

Ehrlichiosis
Rocky Mountain spotted fever (D)
Salmon poisoning disease (D)

Viral

Borna disease virus
Canine distemper* (D)
Canine herpesvirus (D)
Canine parainfluenza (D)
Canine parvovirus* (D)
Central European tick-borne encephalitis
Feline immunodeficiency virus* (C)
Feline infectious peritonitis* (C)

Feline leukaemia virus* (C)
Infectious canine hepatitis* (D)
Pseudorabies
Rabies

Non-infectious

Eosinophilic meningoencephalitis
Fibrocartilaginous embolism
Fucosidosis
Globoid cell leukodystrophy
Granulomatous meningoencephalomyelitis
Idiopathic tremor syndrome
Intervertebral disc disease
Meningoencephalomyelitis in pointers
Necrotising encephalitis
Neoplasia
Periventricular encephalitis
Polioencephalomyelitis
Pug and Maltese encephalitis
Pyogranulomatous meningoencephalomyelitis
Steroid-responsive meningoencephalomyelitis and polyarteritis
Yorkshire terrier encephalitis

4.5.7 Fine-needle aspiration of cutaneous/ subcutaneous masses

Neoplasia

Epithelial

Basal cell tumour
Papilloma
Perianal adenoma*
Sebaceous adenoma/hyperplasia*
Sebaceous gland tumours*
Squamous cell carcinoma*
Sweat gland tumours

Mesenchymal

Haemangiopericytoma
Lipoma*

Sarcoma*, e.g.

- Chondrosarcoma
- Fibrosarcoma
- Haemangiosarcoma
- Osteosarcoma

Round cell

Histiocytoma* (D)

Lymphoma

Mast cell tumour*

Melanoma

Plasmacytoma

- Transmissible venereal tumour (D)

Inflammatory cells

Abscess*

Cellulitis*

Panniculitis

Pyoderma*

4.6 Hormones/endocrine testing

4.6.1 Thyroxine

Decreased

Neonatal cats*

Normal value is lower in sighthounds

Drugs

Amiodarone

Anabolic steroids

Anaesthetics

Anticonvulsants

- Phenobarbitone
- Phenytoin

Furosemide

Glucocorticoids

Iodine supplementation

Methimazole

NSAIDs

- Carprofen
- Flunixin
- Phenylbutazone
- Salicylates

Progestagens

Propranolol

Propylthiouracil

Sulphonamides

Non-thyroidal illness (sick euthyroid syndrome), many conditions, e.g.*

Acute diseases

- Acute hepatitis* *q.v.*
- Acute pancreatitis*
- Acute kidney injury *q.v.*
- Autoimmune haemolytic anaemia*
- Bacterial bronchopneumonia*
- Canine distemper virus* (D)
- Intervertebral disc disease* (D)
- Polyradiculoneuritis
- Sepsis*
- Systemic lupus erythematosus

Chronic diseases

- Cachexia
 - Cardiac*
 - Neoplasia*
- Chronic kidney disease* *q.v.*
- Congestive heart failure*
- Dermatological disease* *q.v.*
- Diabetes mellitus*
- Gastrointestinal disease* *q.v.*
- Hyperadrenocorticism
- Hypoadrenocorticism (D)
- Liver disease* *q.v.*
- Lymphoma*
- Megaoesophagus
- Systemic mycoses

Primary hypothyroidism

- Acquired*
- Congenital

Increased

- Diet
- Soy

Hyperthyroidism* (C)

Juvenile dogs*

Obesity*

Pregnant bitches*

Strenuous exercise*

Total T4 autoantibodies

Thyroid carcinoma

Drugs

- Excessive thyroid hormone supplementation
- Ipodate

4.6.2 Parathyroid hormone

Decreased

Artefact

- Prolonged storage/transport above freezing

Hypervitaminosis D

Non-parathyroid causes of hypercalcaemia

Primary hypoparathyroidism

Drugs that increase serum calcium

(see Hypercalcaemia)

Increased

Hyperadrenocorticism

Non-parathyroid causes of hypocalcaemia *q.v.*

Nutritional secondary hyperparathyroidism

Primary hyperparathyroidism

Renal secondary hyperparathyroidism*

Drugs that decrease serum calcium

(see Hypocalcaemia)

4.6.3 Cortisol (baseline or post-ACTH stimulation test)

Increased

Severe/chronic illness*

Stress*

Artefact

Cross-reaction with glucocorticoids
(but not dexamethasone)

- Cortisone
- Hydrocortisone
- Methylprednisolone
- Prednisolone
- Prednisone

Drugs

Anticonvulsants

Hyperadrenocorticism

Adrenal dependent
Pituitary dependent

Decreased

Artefact

Prolonged/improper storage of ACTH
Incorrect administration of ACTH

Drugs

Chronic androgen administration
Chronic glucocorticoid administration
Chronic progestagen administration
Megestrol acetate

Hypoadrenocorticism (D)

Primary
Secondary

4.6.4 Insulin

With concurrent hyperglycaemia

Decreased

Diabetes mellitus*

Increased

Insulin-binding antibodies

Insulin resistance*

With concurrent hypoglycaemia

Increased

Insulinoma

4.6.5 ACTH

Decreased

Adrenal-dependent hyperadrenocorticism

Iatrogenic hyperadrenocorticism

Spontaneous secondary hyperadrenocorticism

Artifact

Collecting into glass containers

Storing above freezing

Increased

Ectopic ACTH secretion

Insulin administration

Pituitary-dependent hyperadrenocorticism

Primary hypoadrenocorticism

4.6.6 Vitamin D (1,25-dihydroxycholecalciferol)

Decreased

Chronic kidney disease

Lymphoma

Primary hyperparathyroidism
Vitamin D-deficient diet

Increased

Exogenous administration
Granulomatous disease
Humoral hypercalcaemia of malignancy
Primary hyperparathyroidism
Vitamin D-based rodenticides

4.6.7 Testosterone

Decreased

Castrated male
Sertoli cell tumour*
Drugs

- Exogenous androgen treatment

Artefact

Collection into EDTA
Storage at room temperature
Storage with red blood cells

Increased (post GnRH or hCG)

Functional testicular tissue
Ovarian thecoma

4.6.8 Progesterone

Decreased

Artefact

- Storage at room temperature
- Storage in whole blood

Exogenous progestagen administration
Failure to maintain normal luteal function
Failure to ovulate

Imminent parturition
Normal anoestrus

Increased

Adrenocortical carcinoma
Granulosa cell tumour
Luteal cysts
Normal luteal function
Ovarian remnant syndrome
Prostaglandin therapy
Recent ovulation

4.6.9 Oestradiol

Increased

Follicular ovarian cysts
Ovarian remnant syndrome
Seminoma*
Sertoli cell tumour*

4.6.10 Pro-BNP

Increased

Acquired cardiac disease, e.g.

- Mitral valve disease *(D)
- Dilated cardiomyopathy *(D)
- Hypertrophic cardiomyopathy *(C)
- Pulmonary hypertension

Congenital cardiac disease, e.g.

- Patent ductus arteriosus

Non-cardiac disease

- Azotaemia
- Babesiosis

Physiological

- Variation over time in an individual

4.7 Faecal analysis findings

4.7.1 Faecal blood

See Haematochezia *q.v.* and Melaena *q.v.*

Note: Tests for occult blood may be positive if red meat has been fed in the previous five days.

4.7.2 Faecal parasites

Cardiorespiratory parasites shed in faeces

Aelurostrongylus abstrusus

Angiostrongylus

Capillaria aerophila

Crenosoma vulpis (D)

Euceleus boehmi

Paragonimus kellicotti (D)

Flukes

Alaria spp.

Hookworms

*Ancylostoma** spp.

*Uncinaria** spp.

Protozoa

*Cryptosporidium** spp.

*Giardia** spp.

Toxoplasma gondii

Tritrichomonas foetus

Roundworms

Toxascaris leonina

Toxocara canis

Toxocara cati

Tapeworms

*Taenia** spp.

Threadworm*Strongyloides* spp.**Whipworms***Trichuris vulpis****4.7.3 Faecal culture****Culture for specific enteropathogenic bacteria***Campylobacter* spp.**Clostridium difficile***Clostridium perfringens***Escherichia coli**

- Enterohaemorrhagic
- Enteropathogenic
- Enterotoxigenic

Salmonella spp.**Yersinia* spp.**Non-selective culture**

Non-selective culture is thought to be of limited diagnostic use.

4.7.4 Faecal fungal infections*Histoplasma capsulatum***4.7.5 Undigested food residues**

Note: Trypsinogen-like immunoreactivity is a more sensitive test for exocrine pancreatic insufficiency than is the presence of undigested food residues.

Fat

Bile acid deficiency

Exocrine pancreatic insufficiency

Malabsorption*

Starch

Exocrine pancreatic insufficiency

High-starch diet

Increased intestinal transit time

PART 5

ELECTRODIAGNOSTIC TESTING

5.1 Electrocardiographic findings

Note: Changes in ECG measurements are relatively insensitive indicators of chamber size.

5.1.1 Alterations in P wave

Tall P wave (P pulmonale)

Right atrial enlargement, e.g.

- Chronic respiratory disease*
- Dilated cardiomyopathy*
- Tricuspid regurgitation*

Wide P wave (P mitrale)

Left atrial enlargement*, e.g.

- Dilated cardiomyopathy*
- Mitral regurgitation*

Variable height of P wave (wandering pacemaker)

Increased vagal tone*

Absent P wave

*Atrial fibrillation**

Acute atrial stretch

- Volume overload

Atrial pathology

Excessive vagal stimulation

Large atria*

Persistent atrial standstill

Artefact

Atrial pathology

Hyperkalaemia

Sinus arrest/sino-atrial block

Normal in brachycephalics

Drugs, e.g.

- Beta blockers
- Calcium channel blockers
- Digitalis glycosides

Atrial disease, e.g.

- Cardiomyopathy*
- Dilatation*
- Fibrosis
- Hypertrophy
- Necrosis

Electrolyte imbalances*

Increased vagal tone

- Chronic respiratory disease*
- Gastrointestinal disease*

Sick sinus syndrome

Stenosis of bundle of His

5.1.2 Alterations in QRS complex

Tall R waves

Left ventricular enlargement, e.g.

- Cardiomyopathy*
- Hyperthyroidism* (C)
- Mitral regurgitation*

Small R waves

Acute haemorrhage
Pericardial effusion

Wide QRS

Supraventricular

Left bundle branch block

- Cardiomyopathy*
- Subaortic stenosis*
- Drugs/toxins, e.g.
 - Doxorubicin
 - Tricyclic antidepressants

Right bundle branch block

- Occasionally seen in normal animals
- Cardiac neoplasia
- Heartworm disease
- Inherited
- Post cardiac arrest
- Ventricular septal defect

Left ventricular hypertrophy*

Microscopic intramural myocardial infarction

Quinidine toxicity

Severe ischaemia

Ventricular

Accelerated idioventricular rhythm*

Ventricular ectopy*

Ventricular escape complexes

Ventricular premature complexes*

Ventricular tachycardia*

Deep S waves

Right ventricular enlargement, e.g.

- Pulmonary hypertension
- Pulmonic stenosis
- Reverse-shunting patent ductus arteriosus
- Tricuspid regurgitation

Electrical alternans

Pericardial effusion

Slurred upstroke

Ventricular pre-excitation/Wolff–Parkinson–White syndrome

- Acquired heart defects, e.g.
- Feline hypertrophic cardiomyopathy
- Congenital
- Idiopathic

5.1.3 Alterations in P–R relationship

Prolonged P–R interval (first-degree atrioventricular block)

Occasionally seen in normal animals*

Age-related degeneration of atrioventricular conduction system

Drugs/toxins

- Beta blockers
- Calcium channel blockers
- Cardiac glycosides
- Quinidine
- Tricyclic antidepressants
- Vitamin D rodenticides

Feline dilated cardiomyopathy (C)

Heart disease*

Hyperkalaemia *q.v.*

Hypokalaemia* *q.v.*

Increased vagal tone*

Short P–R interval

Ventricular pre-excitation/Wolff–Parkinson–White syndrome

- Acquired heart defects, e.g.
- Feline hypertrophic cardiomyopathy
- Congenital
- Idiopathic

Intermittent failure of atrioventricular conduction (second-degree atrioventricular block)

May be seen in normal animals

Juvenile puppies at rest

Physiological when seen associated with supraventricular tachycardia

Drugs, e.g.

- Alpha-2 agonists
- Atropine
- Beta blockers
- Calcium channel blockers
- Cardiac glycosides

Electrolyte imbalances* *q.v.*, e.g.

- Hyperkalaemia *q.v.*

Hyperthyroidism* (C)

Increased vagal tone, e.g.

- Chronic respiratory disease* *q.v.*
- Gastrointestinal disease* *q.v.*

Microscopic idiopathic fibrosis

Myocardial diseases

Stenosis of bundle of His

Complete atrioventricular block (third-degree atrioventricular block)

Idiopathic

Bacterial endocarditis

Congenital heart defects, e.g.

- Aortic stenosis
- Ventricular septal defect

Hyperkalaemia

Isolated congenital atrioventricular block

Myocardial diseases including infiltrative disorders

Myocardial infarction

Myocarditis

Severe drug intoxication, e.g.

- Beta blockers
- Calcium channel blockers
- Cardiac glycosides

5.1.4 Alterations in S-T segment

S-T segment depression/slur

Acute myocardial infarction

Cardiac trauma

Digitalis toxicity

Electrolyte disturbances* *q.v.*
Myocardial ischaemia

S-T segment elevation

Myocardial hypoxia
Myocardial infarction
Myocardial neoplasia
Pericarditis

Secondary changes to S-T segment following QRS abnormalities

Bundle branch block
Ventricular hypertrophy
Ventricular premature complexes*

Pseudo-depression of S-T segment (prominent atrial repolarisation wave)

Pathological atrial changes
Tachycardia *q.v.*

5.1.5 Alterations in Q-T interval

Prolonged Q-T interval

Central nervous system disease *q.v.*
Drugs/toxins

- Amiodarone
- Ethylene glycol
- Quinidine
- Tick paralysis
- Tricyclic antidepressants

Exercise*

Hypocalcaemia *q.v.*
Hypokalaemia* *q.v.*
Hypothermia* *q.v.*

Shortened Q-T interval

Hypercalcaemia *q.v.*

Hyperkalaemia *q.v.*

Drugs/toxins

- Cardiac glycosides

5.1.6 Alterations in T wave

Tall T waves

- Anaesthetic complications
- Bradycardia *q.v.*
- Heart failure*
- Hyperkalaemia *q.v.*
- Hyperventilation during heat stroke
- Left bundle branch block
- Myocardial hypoxia
- Myocardial infarction
- Right bundle branch block

Small T waves

- Hypokalaemia* *q.v.*

T wave alternans

- Hypocalcaemia *q.v.*
- Increased circulating catecholamines
- Increased sympathetic tone

5.1.7 Alterations in baseline

- Atrial fibrillation
- Atrial flutter
- Movement artefact*
- Ventricular fibrillation
- Ventricular flutter

5.1.8 Rhythm alterations

Atrial fibrillation

- Anaesthesia
- Gastrointestinal disease*
- Hypoadrenocorticism (D)
- Hypothyroidism* (D)
- Primary/'lone'

Rapid, large-volume pericardiocentesis

Severe atrial enlargement, e.g.

- Dilated cardiomyopathy*
- Mitral regurgitation*
- Patent ductus arteriosus

Volume overload

Atrial flutter

Cardiomyopathy

Iatrogenic

- Cardiac catheterisation

Severe atrial enlargement, e.g.

- Dilated cardiomyopathy*
- Mitral regurgitation*
- Patent ductus arteriosus

Drugs

- Quinidine

Atrioventricular block q.v.

Parasystole

Atrial

Ventricular

Persistent atrial standstill

Artefact

Atrial pathology

Hyperkalaemia

Sinus block/arrest

Atrial disease, e.g.

- Cardiomyopathy*
- Dilatation*
- Fibrosis
- Hypertrophy
- Necrosis

Electrolyte imbalances* q.v.

Increased vagal tone

- Chronic respiratory disease*
- Gastrointestinal disease*

Sick sinus syndrome

Stenosis of bundle of His

Drugs, e.g.

- Beta blockers
- Calcium channel blockers
- Digitalis glycosides

Supraventricular premature complexes/ supraventricular tachycardia (sinus, atrial or junctional tachycardia)

May be normal

Structural cardiac disease, e.g.

Atrial enlargement*

Myocardial disease

Systemic disease, e.g.

Drugs, e.g.

- Digoxin
- General anaesthesia

Hyperthyroidism* (C)

Inflammation*

Neoplasia*

Sepsis*

Ventricular premature complexes/ventricular tachycardia

Cardiac disease

Cardiomyopathy, e.g. dilated cardiomyopathy and arrhythmogenic right ventricular cardiomyopathy

Congestive heart failure*

Endocarditis, e.g.

- Bacterial

Inherited, e.g.

- German Shepherd dogs

Myocardial infarction

Myocarditis, e.g.

- Idiopathic
- Traumatic
- Viral

Neoplasia
Pericarditis

Extra-cardiac disease

Anaemia* *q.v.*

Autonomic imbalances*

Coagulopathies *q.v.*

Disseminated intravascular
coagulation

Drugs/toxins

- Atropine
- Anti-dysrhythmics, e.g.
 - Amiodarone
 - Digoxin
 - Lignocaine
 - Sotalol
- Dobutamine
- Dopamine
- Glycopyrronium bromide
- Halothane
- Propantheline bromide
- Theobromine
- Tricyclic antidepressants
- Xylazine
- Vitamin D rodenticides

Endocrinopathies*

Gastric dilatation/volvulus*

Hypoxia

Nutritional deficiencies

Pancreatitis*

Sepsis*

Uraemia* *q.v.*

Ventricular flutter/fibrillation

Ventricular asystole

Electrolyte/acid-base disorders

Severe sino-atrial block

Terminal systemic disease
Third-degree atrioventricular block

5.1.9 Alterations in rate

Tachycardia

Sinus tachycardia

Physiological

- Excitement*
- Exercise*
- Fear*
- Pain*

Drugs/toxins

- Adder bites
- Baclofen
- Blue-green algae
- Cannabis
- Ethylene glycol
- Glyphosate
- Ibuprofen
- Metaldehyde
- Paracetamol
- Paraquat
- Petroleum distillates
- Phenoxy acid herbicides
- Pyrethrins/pyrethroids
- Salbutamol
- Selective serotonin reuptake inhibitors
- Terfenadine
- Theobromine
- Tricyclic antidepressants
- Vitamin D rodenticides
- Heart failure*
- Respiratory disease*
- Shock*

Pathological

- Systemic disease
 - Anaemia* *q.v.*
 - Fever* *q.v.*

- Hyperthyroidism* (C)
- Hypoxia
- Sepsis*

Other supraventricular tachycardia

Atrial fibrillation

Atrial flutter

Ectopic atrial tachycardia

Junctional tachycardia

- Automatic junctional tachycardia
- AV nodal re-entrant tachycardia
- Bypass tract-mediated macro-re-entrant tachycardia

Sinus nodal re-entrant tachycardia

Ventricular pre-excitation/Wolff–Parkinson–White syndrome

Ventricular tachycardia *q.v.*

Bradycardia

Atrial standstill

- Atrioventricular myopathy
- Dilated cardiomyopathy*
- Hyperkalaemia *q.v.*

Heart block *q.v.*

Sick sinus syndrome

Sinus arrest

Sinus bradycardia

Normal in athletic dogs, during rest/sleep

Cardiac disease

- End-stage heart failure*
- Feline dilated cardiomyopathy (C)

Drugs/toxins

- Adder bites

Anti-dysrhythmics

- Beta blockers
- Calcium channel blockers
- Digoxin
- Baclofen
- Cannabis

- Carbamate
- Daffodil
- Glyphosate
- Ivermectin
- Loperamide
- Organophosphates
- Paraquat
- Phenoxy acid herbicides
- Rhododendron
- Theobromine
- Vitamin D rodenticides
- Yew

Hypoglycaemia *q.v.*

Hypothyroidism*

Increased vagal tone, e.g.

- Gastrointestinal disease* *q.v.*
- Respiratory disease* *q.v.*

Neurological disease, e.g.

- Coma

Severe systemic disease*

5.2 Electromyographic findings

5.2.1 Spontaneous activity

Normal end-plate noise

Electrode-insertion artefact

Fibrillation potentials

- Denervation

Myotonic potentials

(dive bomber sound)

- Myotonia

Pseudo-myotonic potentials

- Polymyositis
- Primary myopathies
- Steroid myopathy

5.2.2 Evoked activity

Decreased muscle action potential

Junctionopathies

- Botulism
- Tick paralysis

Neuropathies

Primary myopathies

Increased muscle action potential

Aged animals

Chronic neuropathies

Decremental decrease after repeated stimulation

Myasthenia gravis

Re-innervation

5.3 Nerve conduction velocity findings

5.3.1 Decreased velocity

Demyelinating neuropathies

Distal part of extremity

Hypothermia of adjacent tissues*

Protein malnutrition

Very old/young animals*

5.3.2 Increased velocity

Proximal part of extremity

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