How to manage the critical in-patient

Management of the critical SA patient is intensive but can be rewarding, writes Laura Cole MA VetMB PgCert VPS CertAVP (ECC) MRCVS, veterinary specialist-in-training, Royal Veterinary College, UK

Regular assessment of the critical patient is key to success, allowing monitoring of the disease process, response to therapy and detection of any complications. Therefore, alongside daily assessment of the parameters pertinent to the primary disease process, and surveillance for new problems is vital. This article will highlight key aspects in the management of the critical in-patient.

PHYSICAL EXAMINATION

A daily, thorough, physical examination is important to assess for any progression of clinical signs relating to the primary disease as well as the development of new clinical findings. Examination should include an assessment of the patient's major body systems (neurological, cardiovascular and respiratory status).

The patient's level of consciousness and response to the surroundings should be assessed. Standardised terminology to describe the patient's alertness are obtundation (mild, moderate and severe), stupor and coma. In any patient that is stuporous or comatosed, a gag reflex should be checked. If an animal has a compromised gag, immediate endotracheal intubation should be performed to minimise the risk of aspiration of oral contents which could lead to aspiration pneumonia.

Cardiovascular assessment includes evaluation of heart rate, pulse quality and presence of any pulse deficits, mucous membrane colour and capillary refill tine. Heart rate and rhythm should be compared to the baseline for the individual patient and interpreted in light of the patient's current pain and stress levels. New murmurs, gallop rhythms in cats, and tachy- and brady-dysrhythmias should be noted and investigated.

Monitoring the respiratory rate and effort of a patient is an effective method of evaluation of the respiratory system. In addition, serial thoracic auscultation of the lung fields is important as subtle changes in respiratory noise may

Figure 1: Jackson-Pratt abdominal drain.

indicate early pulmonary dysfunction or pleural space disease prompting further diagnostics.

Body temperature (ideally rectal) should be monitored at least once daily in the critical patient, with more frequent measurement required in patients with marked pyrexia, hyperthermia or risk factors for its development. Environmental hyperthermia should be differentiated from pyrexia by considering the underlying disease process. Many animals do not tolerate rectal temperature measurement. In these cases, alternative locations can be considered. In cats, axillary temperature measurement is considered a better substitute for rectal temperature than tympanic temperature measurement (Smith et al, 2015; Goic et al, 2015; Cichocki, Dugat & Payton, 2017). Animals receiving active warming should have their temperature assessed more frequently to prevent iatrogenic hyperthermia.

The development of pyrexia in a previously normothermic patient is not uncommon in the hospitalised patient. A full physical examination should be performed in these patients, paying particular attention to the respiratory system. Aspiration pneumonia is a relatively common complication in recumbent critical patients and early detection is key. If the physical examination is unremarkable, removal and replacement of the intravenous catheter can be considered as a first line step as in the author's experience phlebitis secondary to the presence of an intravenous catheter is the most common cause for the development of pyrexia in a hospitalised patient. The requirement for other indwelling devices, such as drains and urethral catheters should also be considered as these can become contaminated and lead to inflammation, hospital-acquired infections and pyrexia, which can clear once the device is removed (see Figure 1).

FLUID BALANCE

Assessment of perfusion parameters (heart rate, pulse quality, mucous membrane colour and capillary refill time) assesses the intravascular fluid volume only. Hydration assessment is considered a subjective measure of interstitial fluid and intracellular fluid. Daily body weight changes reflect fluid balance and therefore may be a more of an objective way to monitor hydration.

When dehydrated, a patient's skin turgor is decreased and so skin tenting is prolonged. Mucous membranes are dry and weight loss occurs. With over hydration, skin turgor increases and the subcutaneous tissue gains a jelly-like consistently. Additional signs of over hydration include weight gain serous nasal discharge and peripheral oedema. Critically ill patients are at increased risk of developing fluid overload and this has been shown to be associated with an increased risk of death (Cavanagh et al, 2016). Therefore, close monitoring of fluid balance to prevent under- or over-hydration is required.

Pre-designed fluid assessment sheets for monitoring ins and outs are useful guides for assessment of fluid therapy. These sheets should include volumes of medication, enteral feeding alongside alongside intravenous fluid therapy. Urine output-measurement methods include free catch of urine, weighing of bedding and incontinence pads as well as the use of ultrasound for estimation of bladder volume (Lisciandro & Fosgate, 2017). Urine output in a well-perfused normally hydrated animal on intravenous fluids should be 1-2ml/kg/hr. Urethral catheterisation should be performed in patients where olig- or anuria (urine output < 1mlg/kg/hr) is suspected , especially in those patients that have gained weight. Urethral catheterisation may also be performed in non-ambulatory patients to maintain comfort and prevent urine scald. Urethral catheters should always be placed in a sterile manner with a closed collection bag to minimise the risk of hospital-acquired urinary-tract infection.

LABORATORY DATA

Bedside laboratory data can aid interpretation of physical examination, allowing perfusion and hydration assessment alongside assessing for blood glucose, acid-base and electrolyte abnormalities that may occur secondary to the disease state or interventions.

Lactate is a marker of tissue perfusion; elevated lactate alongside compatible clinical signs (tachycardia, changes in pulse quality, prolonged capillary refill time, cold extremities and hypotension) is indicative of poor perfusion. Lactate itself can also be elevated secondary to certain drug therapies including glucocorticoids and underlying disease states such as neoplasia and liver disease. It therefore, should be interpreted in light of clinical assessment of the patient.

Packed cell volume and total solids measurement, alongside assessment of the serum for icterus, lipaemia or haemolysis should be performed at least once a day in critical patients. Hypoprotienaemia is common in critical patients and has been associated with increased risk of wound dehiscence post-intestinal surgery (Ralphs, Jessen, Lipowtiz 2003; and Swinbourne et al, 2017). Management of hypoalbuminaemia involves treating the underlying disease and providing nutritional support.

Anaemia is common in critically ill patients, particularly in cats. In one study three quarters of cats developed anaemia during intensive care unit (ICU) hospitalisation and this was thought to be at least partly related to repeated blood sampling (Balakrishnan, Drobatz & Reineke, 2016). Care should be taken in these critical patients to only draw the minimum volume of blood required for the tests required to minimise the risk of development of anaemia. The optimum packed cell volume (PCV) for oxygen transport is 27-33% so close monitoring of a declining PCV and pre-emptive blood typing could be performed.

Patients that are anorexic in hospital are likely to develop hypokalaemia, particularly if they are on non-supplemented intravenous fluid therapy. At least once daily monitoring of potassium levels and supplementation as required should be based on published guidelines.

Glucose measurement should be performed frequently in all patients, particularly in juvenile patients and small

breed dogs. The development of hypoglycaemia in adult dogs and cats should prompt the consideration of sepsis. Supplementation of 2.5%-5% dextrose in an isotonic crystalloid such as 0.9% saline should be considered in these patients (see Figure 3).

Glucose concentration	
2.5%	50ml of 50% dextrose added to 950ml of 0.9% saline
5%	100ml of 50% dextrose added to 900ml of 0.9% saline

Figure 3: Guide to glucose supplementation

Daily examination of a blood smear allows subjective assessment of neutrophil and platelet numbers, as well as the presence of red-cell regeneration and erythrocyte morphology. This is very useful in monitoring anaemic, neutropenic and thrombocytopenic-critical patients or those with infectious or inflammatory conditions. Patients that are severely neutropenic (< 1x109/L) will require strict barrier nursing and broad-spectrum antibiotics. Thrombocytopenia alongside prolonged coagulation times (prothrombin and partial thromboplastin times) may suggest disseminated intravascular coagulopathy.

PATIENT-SIDE ULTRASOUND

Patient-side ultrasound is a useful tool for the detection and monitoring of free fluid in body cavities, this is particular important in those patients at risk of fluid overload, eg. patients with olig- or anuria, and in monitoring for septic peritonitis post-gastrointestinal surgery. As the clinician's skills increase, patient-side ultrasound also allows assessment of pulmonary pathology, gastrointestinal motility and has been recently shown to be useful, alongside heart rate and blood pressure measurement, in guiding assessment of volume status (Sanderson et al, 2017; Cambournac et al, 2017).

NUTRITION

Nutritional support is crucial part of critical care. Patients that develop a negative energy balance may have decreased immune function and therefore be at risk of pneumonia, sepsis, multiple organ dysfunction and death. Enteral nutrition to support the gastrointestinal tract is the preferred route of nutrition delivery. Daily-recommended calorific requirements should be calculated for all patients by using previously published formula (see Figure 4).

$$RER = 70 \times BW\ (Kg)^{0.75}$$

Figure 4: Calculation of daily energy requirement

If a patient has been anorexic for more than two days, feeding tube placement should be considered, with nasogastric tubes often being a good options as they are cheap and simple to place though they do require the use of a liquid food.

Initially, 10-30% RER should be fed with close monitoring for signs of intolerance such as regurgitation or diarrhoea. Syringe feeding is unlikely to provide enough calorie requirements and is associated with food aversion and increased risk of aspiration and therefore is not recommended. If the patient does not tolerate enteral feeding, parenteral nutrition could be provided through a peripheral vein but requires close monitoring for lipaemia and electrolyte abnormalities.

ANALGESIA

Adequate analgesia is an essential part of critical care. Pain assessment can be easy when the animal is showing obvious signs of distress including yelping or guarding the injured site. Objective pain scoring systems, such as the short-form Glasgow composite measure pain scale, may be useful to detect and monitor the severity of pain and response to analgesic therapy (University of Glasgow, 2005). These scoring systems should be incorporated into overall patient assessment by the staff, particularly the nurses who provide the minute-by-minute care. If there is any suggestion that the patient is in pain then analgesic medication should be trialled. Opioids are cardiovascular sparing and generally safe to use even in the most critical patient.

PHYSIOTHERAPY

Recumbent patients at are high risk of developing complications such as aspiration pneumonia, urinary tract infections, muscle atrophy, decubital ulcers, urine and faecal scalding and peripheral oedema. Alternating position can improve chest wall expansion, prevent atelectasis and improve oxygenation. Regular turning, soft comfortable bedding which wicks away urine and early mobilisation alongside basic physiotherapy such as assisted standing and range of motion exercises should be considered in all critical patients to prevent these complications. Some patient, such as those with tetanus may require more intensive physiotherapy. A patient's mental health is as important as physical health. Sitting a patient upright or assisted standing can improve a patient's emotional wellbeing alongside owner visits if they do not lead to distress when the owner leaves, plenty of attention from staff and time spent grooming and playing with the patient.

DAILY PATIENT SIDE ROUNDS

Communication between all staff involved in management of critical patients is paramount. Nurses are often better placed at detecting subtle changes in patients if they are providing more regular care and assessment. Discussion between clinicians and nurses is required at least once a day. Another important aspect of hospitalised critical patients is communication with owners. The owners of

critical patients are often understandably upset about their pet needing to be hospitalised for prolonged periods of times so updates should be given at least once daily as well as the opportunity to visit their pet. This can be reassuring for the owner to allow them to see where their pet is kennelled and all members of staff involved in their care.

CONCLUSION

Evaluation of the critical patient is multi-faceted. Assessment of the patient should be performed in a careful step-by-step manner. Individual patient-side assessment should be used alongside feedback from all members of the staffing team to ensure optimum patient care.

REFERENCES

1. Smith VA, Lamb V, McBrearty AR. Comparison of axillary, tympanic membrane and rectal temperature measurement in cats. Journal of Feline Medicine and Surgery, 2015; 17: 1028-1034
2. Goic JB, Reineke EL, Drobatz KJ. Comparison of rectal and axillary temperatures in dogs and cat Journal of the American Veterinary Medical Association 2014; 244: 1170
3. Cichocki B, Dugat D, Payton M. Agreement of axillary and auricular temperature with rectal temperature in systemically healthy dogs undergoing surgery Journal of the American Animal Hospital Association 2017; 53: 291-296
4. Cavanagh AA, Sullivan L, Hansen BD. Retrospective evaluation of fluid overload and relationship to outcome in critically ill dogs. Journal of Veterinary Emergency and Critical Care 2016; 26: 578-586
5. Lisciandro GR, Fosgate GT. Use of urinary bladder measurements from a point-of-care cysto-colic ultrasonographic view to estimate urinary bladder volume in dogs and cats Journal of Veterinary Emergency and Critical Care 2017; 27: 713-717
6. Ralphs CS, Jessen CR, Lipowitz AJ. Risk factors for leakage following intestinal anastomosis in dogs and cats: 115 cases (1991–2000) Journal of the American Animal Medical Association 2003; 223: 73-77
7. Swinbourne F, Jeffry N, Artingstall R et al. The incidence of surgical site dehiscence following full-thickness gastrointestinal biopsy in dogs and cats and associated risk factors. Journal of Small Animal Practice 2017; 58: 495-503
8. Mazzafero EM, Rudloff E, Kirby R. The role of albumin replacement in the critically ill veterinary patient. Journal of Veterinary Emergency and Critical Care 2002; 12: 113
9. Balakrishnan, Drobatz, Reineke. Development of anemia, phlebotomy practices, and blood transfusion requirements in 45 critically ill cats (2009-2011) Journal of Veterinary Emergency and Critical Care 2016; 26: 406-411
10. Sanderson JJ, Boysen SR, McMurray JM et al. The effect of fasting on gastrointestinal motility in healthy dogs as assessed by sonography Journal of Veterinary Emergency and Critical Care 2017; 27: 645-650
11. Cambournac M, Goy-Thollet I, Violé A et al. Sonographic assessment of volaemia: development and validation of a new method in dogs. Journal of Small Animal Practice 2017; doi: 10.1111/jsap.12759
12. University of Glasgow, Faculty of Veterinary medicine, Glasgow Pain Scale. gla.ac.uk/faculties/vet/research/cascience/painandwelfare/cmps.htm (2005)

READER QUESTIONS AND ANSWERS

1. WHICH OF THE FOLLOWING CAN INDICATE OVERHYDRATION?

A. HYPERDYNAMIC PULSES
B. INCREASED SKIN TURGOR
C. OCULAR DISCHARGE
D. WEIGHT LOSS

2. WHAT IS THE NORMAL URINE OUTPUT FOR A PATIENT ON FLUID THERAPY?

A. <1ML/KG/HR
B. 1-2ML/KG/HR
C. 2-3ML/KG/HR
D. >3ML/KG/HR

3. WHAT IS THE BEST WAY OF DELIVERING SHORT-TERM NUTRITIONAL SUPPORT TO A CRITICALLY ILL PATIENT?

A. SYRINGE FEEDING
B. NASOGASTRIC-FEEDING TUBE
C. OESOPHAGOSTOMY TUBE
D. JEJUNOSTOMY TUBE

4. NAME THREE CONSEQUENCES OF PROLONGED RECUMBENCY.

ANSWERS: 1: B; 2: B; 3: B; 4: ASPIRATION PNEUMONIA, URINARY TRACT INFECTIONS AND MUSCLE ATROPHY