cpdsolutions
transferring knowledge through excellence in training

Emergency and Critical Care Nursing Mini Series

Session 1: Triage, Assessment and Monitoring of Emergency Patients

Paul Aldridge BVSc CertSAS MRCVS

TRIAGE

Definitions

- “Triage is the evaluation of a patient, and allocation of treatment, according to a system of priorities designed to maximize the number of survivors.”
- “Examination and classification of patients to determine priority of need, and the optimal order in which they should be treated.”

These definitions probably originate from human medicine, where triage is well established and used in busy A & E departments, or at the scene of major incidents. However, the exact same principles apply in veterinary medicine, whether in a dedicated emergency/out of hours practice or when dealing with an urgent case in a first opinion practice. By finding out as much information as possible, in as short a space of time as possible, we can act quickly and just as importantly, appropriately. The information we gather is verbal in the form of a clear, concise, relevant history, and physical from our findings at examination.

Emergency cases can be some of the most challenging and rewarding cases to deal with. Carried out correctly, triage should improve care and survival rates of our patients, improve the efficiency of the clinical TEAM. By correctly training and empowering nurses to be involved in this side of work, we find job satisfaction is also hopefully improved!

This course cannot hope to cover every possible type of emergency case that may present to you, but hopefully by covering the principles of triage and correct assessment, we can anticipate and prevent a lot of problems before they occur.

Evaluating an emergency patient has several stages, all of which are important:

-Telephone Triage

-Hospital Triage

-Initial or Primary Evaluation

-Initial Treatment

-Secondary or Full Examination

-Emergency/Treatment Plan

Telephone Triage

From the initial contact with the client, we can start to gather essential information to help treat the patient. Most importantly does the patient need to be seen urgently by the vet, and if so what then what can we start preparing ready for the patients arrival? Simply by learning the nature of the problem, and the size/breed or weight of the animal we can have most of what we will need ready and at hand, including appropriate IV catheters, volumes of fluid, suitable endo-tracheal tubes, means of supplementing oxygen etc. It should be possible to establish an estimated time of arrival, so staff are warned of what's coming, and can hopefully be available to deal with it.

When obtaining information on the telephone, it may be necessary to calm the owner prior to trying to obtain concise accurate information. The owner's perception of the problem should be interpreted with caution. If in any doubt about the need for the animal to be seen, it is safest to advise the owner to attend.

Patients with certain symptoms should be seen immediately:

- Respiratory distress
- Severe coughing
- Pale mucous membranes
- Weakness
- Neurological abnormalities
- Protracted vomiting
- Abdominal distension
- Bleeding from body orifices
- Inability to urinate
- Ingestion of toxins.
- Extreme pain
- Traumatic injury
- Dystocia

Owners who phone because they have noted these symptoms should be seen urgently, obtain a brief history, routine signalment (age, breed, sex etc) the animals approximate size, and an estimated time of arrival.

Where an owner phones with a more vague presentation, it is worth asking a standard set of questions to determine the urgency of the problem. Each case is different so appropriate follow up questions will be required!

‘**Medical ‘ presentations**:

How is the patient breathing?

What colour are the gums

Any loss of consciousness/altered mentation?

Any vomit or diarrhoea- frequency/duration/haemorrhagic?

Any abdominal distension?

Can the patient urinate?

Any medication currently being given?-

‘Trauma’ related presentations:

How and when did the injury occur?

How is the patient breathing

What colour are the gums

Any evidence of bleeding

What is the level of consciousness

Can the animal walk? On all 4 limbs?

If the owner is advised to attend the clinic, then give clear directions on how to get there!- they may only have been to a branch previously. Advise may need to be given on transportation of the animal, especially following trauma: if an animal is unable to walk it may need to be carried, it is preferable to a trauma victim to be carried on a board or something rigid rather than a blanket etc. In the case of active bleeding, direct pressure onto a clean cloth is probably safer than tourniquets etc. Always warn the owner that the animal may be aggressive due to pain etc.

Hospital Triage

On arrival at the practice, every animal should be quickly assessed by a member of the team to see if the animal requires attention immediately, or if the patient is able to wait while more urgent cases are seen (if necessary). Certain presentations should be taken straight to the treatment area/prep room immediately regardless of findings, these include:

Seizures	Ingestion Toxins
Trauma	Excessive Bleeding
Prolapsed organs	Open fractures
Dystocia	Burns
Dead on Arrival	

Cases that are not in these categories should be assessed in terms of major body systems:

Respiratory System- visually assess respiratory rate and effort, listen for respiratory noise with and without a stethoscope, looks for behavioural and postural signs of distress- flared nostrils/abducted elbows, extended neck, open mouth breathing.

Cardiovascular System- look for signs of bleeding, check mucous membrane colour, capillary refill time (too fast or too slow). PULSES- strength and duration, rate.

Central Nervous System- responsive? Alert? Altered mentation?

ANY ANIMAL SHOWING DYSFUNCTION OF THESE MAJOR ORGAN SYSTEMS SHOULD BE TAKEN TO TREATMENT AREA. These problems need to be addressed before a more thorough assessment.

Abdominal palpation- After examination of the major body systems, the abdomen can be palpated. Is there pain or guarding? Is a large hard urinary bladder present? Is a fluid thrill present?

Body Temperature- rectal thermometer. Hypothermia? Hyperthermia? > 40C (104F) concern, > 42C (107F) life threatening.

INITIAL EVALUATION

Once the patient has been admitted, more information regarding the major organ systems can be gathered- the purpose being to determine the stability of the patient and identify and treat any immediately life threatening conditions. Unstable patients can have appropriate monitoring initiated.

Respiratory System; If in any doubt give oxygen! Definitive treatment for the cause of respiratory compromise should be provided as soon as possible. Careful auscultation and observation of the breathing pattern will often determine the location of the cause of dyspnoea, be it upper or lower airway, or pleural space disease. This can be essential as often dyspnoeic animals have little or no physiological reserve. The stress of a conscious x-ray to determine a pleural effusion may kill a cat, whereas if you are confidant from your examination, careful thoracocentesis will be diagnostic and therapeutic.

Circulation/Cardiovascular system: Assessed via visual observation, palpation and auscultation.

Mucous membranes; Colour- pale/white- anaemia, vasoconstriction
Brick red/injected- vasodilation, hyperthermia
Cyanotic- hypoxia
Capillary refill time- normal is 1-1.75 seconds
Prolonged refill time- vasoconstriction.
Decreased/rapid refill- vasodilation.

Pulse- palpation of femoral and distal pulses will reveal pulse rate and rhythm. Palpate while listening to the heart to detect any pulse deficits. Pulse quality gives an idea of stroke volume- how much blood is pumped with each beat.

Heart- auscultate for rate, rhythm and presence of murmurs.
Indicators of poor tissue perfusion warrant rapid identification of the underlying cause and definitive treatment. Continued hypoperfusion will lead to cell death and release of free radicals and inflammatory mediators.

Central Nervous System
Neurological status is assessed with a brief exam to assess the level of consciousness. Pupillary light reflexes, posture, response to pain can quickly be checked. Any seizure activity may be due to intra-cranial or extra-cranial causes.
Depressed mentation can be due to poor oxygen delivery to the brain- but if this seems more severe than would be indicated by exam of the respiratory and circulatory system, suspect CNS problems.

Secondary Evaluation
Once any life threatening conditions have been stabilised, a more thorough secondary examination can be carried out, a detailed history can be obtained from the owner, and response to initial treatment can be assessed.

More in-depth diagnostic procedures can be performed, such as imaging etc, allowing an ongoing treatment and nursing plan to be formulated to deal with each specific problem in order of priority. A written hospital order sheet covering fluid therapy, feeding, medication, diagnostics and nursing requirements should be produced for each patient.

	A CRASH PLAN!
A	Airway
C	CVS/Circulation
R	Respiratory
A	Abdomen
S	Spine
H	Head
P	Pelvis/Rectal Exam
L	Limbs
A	Arteries
N	Nerves

INPATIENT MONITORING TECHNIQUES

Introduction

Close monitoring of the critical patient is essential to determine the effectiveness of any treatment, and to assess the degree of improvement in condition. Just as importantly, changes can be detected that indicate deterioration is imminent; this allows intervention to prevent a crisis before it occurs. The most useful information is provided by observing a 'trend' in the monitored vital sign, rather than a single one-off measurement. To make spotting an ongoing trend easier, a recording sheet or graph is required, with the data entered at specified intervals. How often these parameters are monitored will depend on the severity of the problem and the perceived risk of deterioration. Which parameters are to be monitored also depends on the patient; this should be decided by the clinical team and recorded in the animal's nursing plan. It is far safer to frequently re-assess a few relevant parameters than to repeatedly run a whole bulk of tests that take so much time to complete that deterioration may take longer to detect. Individual practices often have a standardized 'minimum database' of information that is gathered from emergency cases on admission. Where specific problems are suspected from physical examination, more specific monitoring can be performed and further laboratory information may be required, e.g. clotting times, slide saline autoagglutination, blood gases, lactate levels.

Respiratory system

Regular auscultation of the chest fields should be performed to detect any change in lung sounds. Lung sounds that have become muffled may indicate worsening pleural disease; an increase in lung sounds can indicate a worsening of lung or airway pathology. Respiratory rate is useful as an indicator of respiratory disease. An increased rate could indicate a developing pneumothorax for instance, although an increase in respiratory rate (tachypnoea) can also be seen with pain, pyrexia, fear or abdominal distension.

An assessment of respiratory effort can be made by observation of the patient. Changes in posture can be indicative of increased effort: standing rather than sitting, extended neck, flared nostrils, open mouth breathing and increased abdominal movement may be seen. Respiratory function can be considered adequate if partial pressures of both carbon dioxide and oxygen are within normal limits. The method of choice to monitor this is arterial blood gas analysis. Samples are usually obtained via an arterial catheter. Blood gas analysis measures the arterial partial pressure of oxygen (PaO2). Pulse oximetery provides an estimate of the percentage of available haemaglobin that is carrying oxygen (oxygen saturation, SpO2). It does not reveal how the actual amount of oxygen is carried in the blood; this depends on the haemoglobin content. Oxygen saturation gives an idea of the efficiency of gaseous exchange from the inspired air in the alveoli into the body's tissues. Care is required with the placement of the pulse oximetery probe, if left in place for too long it tends to compress tissue and give a false reading. Conscious animals can have the probe placed on toe webs, lips or ears rather than on the tongue. Any animal with a reading of less than 95% SpO2 should receive oxygen supplementation. SpO2 values of 90% correspond to a PaO2 of 60 mmHg. Because of the nature of the oxygen saturation curve, below 60 mmHg there is a rapid drop in oxygen saturation, so aiming for an SpO2 of 95% or above gives some margin of safety.

Cardiovascular system

Heart rate and rhythm

Heart rate can be measured by palpation of an apex beat, palpation of a pulse or auscultation with a stethoscope. Where abnormal rhythms are detected, a continuous electrocardiogram (ECG) should be carried out, and abnormalities recorded. While an ECG is useful to investigate rhythm disturbance, it only shows electrical activity. Just because there is a waveform does not mean there is an output at that point; it is always important to check pulses at the same time as auscultating the heart.

Pulses

Pulses are commonly palpated on the femoral artery, but familiarity with palpating a metatarsal pulse is valuable. Much useful information is gathered from the rate, strength and characteristics of the palpable pulse. A pulse should be present for each heart beat/. If this is not the case, or there are variations in pulse strength, then an ECG is necessary to identify rhythm disturbances. Pulse rate and character are essential in detecting hypovolaemia and the response to treatment. Increasing pulse rate and decreasing amplitude are evidence of worsening hypovolaemia. The distal metatarsal pulse becomes non-palpable with moderate hypovolaemia, but should return if effective therapy is instituted. Importantly, what is palpated as the pulse amplitude is the difference between diastolic and systolic pressures (i.e. an animal with a systolic pressure of 100 mmHg and a diastolic pressure of 60 mmHg would have a similar pulse amplitude to an animal with 70/30 mmHg blood pressure); it cannot accurately measure actual blood pressure. Therefore the pulse needs to be considered in conjunction with measures of tissue perfusion and blood pressure readings.

Mucous membranes and capillary refill time

The mucous membrane colour and capillary refill time (CRT) can help to give an idea of tissue perfusion and vasomotor tone. The oral mucosa is normally used as it is easiest to access. CRT tends to vary with an individual's technique. A normal CRT is usually 1–1.75 s. A slower CRT suggests reduced blood flow in the tissue, often resulting from vasoconstriction with hypovolaemia, or heart failure. A more rapid CRT suggests increased blood present in the tissues; this may be due to vasodilation seen in sepsis. Mucous membranes are normally pink, although healthy cats often have paler membranes than dogs.

Observed changes in mucous membrane colour

Colour observed	Possible cause
Pale, white or grey	Poor perfusion, or anaemia
'Brick red' or 'injected'	Vasodilation, systemic, inflammatory response
Blue or purple	Cyanosis: low oxygen saturation of haemoglobin
Yellow	Increased blood bilirubin levels
Brown	Formation of methaemoglobin, e.g. paracetamol poisoning
Cherry red	Carbon monoxide poisoning

Tissue perfusion

The sole aim of the cardiovascular system is to deliver oxygenated blood to the tissues of the body. All tissues need a supply of oxygenated blood. Monitoring assesses the delivery of this blood to the capillary beds of the tissues. A range of parameters can help to form an overall picture of perfusion:

1) Mucous membrane colour
2) Capillary refill time
3) Peripheral pulse
4) Toe web temperature vs. core temperature
5) Urine output (1.0 ml/kg/hour)
6) Blood lactate levels
7) Arterial pressure.

A systolic arterial pressure of 90 mmHg (equivalent of 60–70 mmHg mean arterial blood pressure) is required for adequate flow to vital organs. It is most practical to use a Doppler system and cuff (non-invasive, indirect measurement).. Alternatives include invasive, direct measurement via an arterial catheter.

Central venous pressure

In cases that require fluid therapy, but there is a risk of fluid ‘overload’ if too much fluid is administered, it is useful to measure central venous pressure. This gives an idea of venous ‘filling’ and how much fluid is returning to the heart. Examples of typical cases would be anuric/oliguric renal failure, or animals in heart failure. A central catheter is required, and the pressure reading can be taken using a manometer, or the central catheter can be connected to a pressure transducer and the wave form constantly monitored.

Central nervous system

An animal may have altered mentation because of conditions inside the skull, such as brain injury, or due to more global conditions such as hypovolaemia, hypoglycaemia or development of a systemic inflammatory response. By monitoring neurological status, and recording findings, it is possible to spot trends quickly that will highlight any deterioration or improvement in the patient’s condition. The use of a scoring system allows an accurate record to be kept of the animal’s status. While there is still some subjectivity involved, allocating an overall score allows a trend to be spotted, and provides continuity from one team member to another. The Small Animal Coma (SAC) scoring system tends to be used. This is an adaptation of the Glasgow Coma Score (GCS) that is used in human medicine. In

the SAC system, a score is allocated from 1 to 6 for each of ‘motor activity’, ‘brainstem function’ and ‘level of consciousness’, giving a maximum score of 18.

Urinary system

Monitoring urine specific gravity and output allows quick and simple assessment of kidney function. Normal urine output is considered to be 1–2 ml/kg/hour. If urine output is at or above this level it is assumed renal perfusion is adequate, and therefore it is likely that perfusion of other organs is also adequate. In animals with an indwelling urinary catheter, a closed collection system provides a means of measuring urine volume. In other animals litter or bedding can be weighed to estimate the urine of volume expelled.

Gastrointestinal system

Patients that are systemically ill can develop vomiting, diarrhoea or ileus. Any vomiting should be recorded, along with any defecation and its nature. Vomiting and diarrhoea will lead to alterations in fluid requirement. The animal’s appetite should be recorded, and food consumed accurately recorded to ensure sufficient requirements. Ileus can be assessed by auscultating the abdomen for the presence of gut sounds.

Fluid balance

All animals receiving fluid therapy need ongoing monitoring to assess effectiveness of therapy, and to prevent under or over-dosing. Important consideration must be given to determining what the patient’s fluid needs are; is the patient hypovolaemic, dehydrated, or both? Hypovolaemic animals need rapid fluid administration, whereas dehydrated animals required correction of their fluid deficit over 24 hours. Physical assessment of perfusion parameters and hydration parameters should be carried out frequently. Patients receiving intravenous fluid therapy need to have their fluid input compared with their fluid output. Fluid input is easily measured by recording the number of fluid bags administered, or more accurately with an infusion pump. Other inputs to consider are any oral fluids or food, and intravenous drugs. Fluid output includes urine, faeces, vomit and any effusions. Urine output can be measured via a urinary catheter, or in animals that are not catheterised disposable bedding can be weighed before and after urination to estimate volume (1 gram = 1 ml urine). Cat litter trays can be weighed in the same way. Volumes of vomit and faeces can be estimated. Volume of effusions can be more difficult to determine, but outputs from thoracic and abdominal drains are easily recorded, as are wound effusions collected in active suction drains. Dressings can be weighed to estimate effusions in situations such as burns, or open abdominal drainage. Some fluid outputs are not measurable, e.g. loss of water as vapour in expired breath; these losses are termed ‘insensible’ losses, and are usually estimated at 20

ml/kg/24 hours. Once the fluid inputs and outputs have been established, they can be compared. Any large discrepancies should be investigated. In a hypovolaemic patient we would expect the 'ins' to be much greater than the 'outs' as the deficit is corrected. In a patient with normovolaemia, the 'ins' should be slightly greater than the 'outs'. Patients should also be weighed accurately at least twice a day; any large gains or losses are likely to be caused by fluid imbalance.

Body temperature

Prolonged abnormal body temperatures can cause potentially fatal organ dysfunction. Abnormal body temperatures interfere with a patient's homeostatic mechanisms, and so delay return to normal health. Critically ill animals are less able to regulate their body temperature. Where active warming is employed in hypothermic animals, care must be taken not to cause overheating, or localized burning.

Clinical pathology

Blood glucose

As well as the obvious cases where blood glucose levels are important, such as monitoring a diabetic ketoacidosis patient, control of blood glucose levels are essential in other critical patients. Hypoglycaemia is commonly seen in hypovolaemia, sepsis, hyperthermia and liver disease. The use of handheld glucometers makes glucose level testing quick and easy, and allows rapid adjustment of glucose supplementation via intravenous fluids.

Packed cell volume and total protein

Trends in packed cell volume (PCV) and total protein (TP) can be interpreted together to give information regarding fluid balance or ongoing haemorrhage. Changes in both may be in the same direction, but alterations in the ratio give extra information:

- Increase in PCV and TP: dehydration
- Decrease in PCV and TP: aggressive intravenous fluid therapy (IVFT), haemorrhage (later, after interstitial fluid moves into intravascular space, initially no change or even increased PCV with decreased TP, due to splenic contraction)
- Decreased PCV, normal TP: increased destruction of red blood cells?
- Increased PCV, decreased TP: dehydration with protein loss, e.g. haemorrhagic gastroenteritis (HE).

PCV and TP are important in guiding fluid therapy and choice of fluid, e.g. colloid, crystalloid.

Electrolytes

Electrolyte disturbances are common in critical patients, either because of their presenting complaint or as a result of fluid therapy or drug administration. Electrolytes should be repeatedly checked during hospitalisation. Most isotonic crystalloids used for fluid maintenance (e.g. Hartmann's solution) have insufficient potassium levels for maintenance requirements.

Lactate

Lactate is a byproduct of anaerobic respiration and is normally cleared from the blood by the liver, kidney and skeletal muscle. Raised lactate in the bloodstream (hyperlactataemia) is usually caused by a state of tissue hypoperfusion and/or hypoxia. This causes pyruvic acid to be preferentially converted to lactate during anaerobic respiration. Hyperlactataemia is defined as plasma lactate >2 mmol/L.

Pain scoring

It can frequently be difficult to assess pain accurately based on behaviour in a debilitated or nervous animal. Equally, physical manifestations of pain may make the measuring of other parameters difficult. Indicators of pain can be subtle, and can include the following:

- Tachycardia, cardiac arrhythmias
- Pale mucous membranes
- Depression, aggression, restlessness
- Changes in posture and facial expression
- Vocalisation
- Hypotension or hypertension
- Anorexia.

As well as being a welfare issue, pain and fear lead to high levels of blood cortisol which will have detrimental effects of the immune system and healing. Pain may lead to poor respiratory function and reduced ventilation. The role of pain scoring has long been established in human medicine. Applying similar schemes directly to veterinary patients can be difficult as verbal feedback and description from the patient is required. Veterinary pain scales have been devised that attempt to score pain based purely on observable parameters and behaviours, examples include the Melbourne Veterinary Pain Scale and the Glasgow Composite Pain Scale.