CRITICAL CARE NURSING

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Nursing is defined as the "scientific care of the sick", while critical is defined as "pertaining to a crisis".

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There are three types of critical care patients.

These are as follows:-

- animals with increased risk of developing complications admitted to ICU for intensive monitoring and care

- physiologically stable patients that require extensive nursing care

- animals requiring constant medical attention eg RTA, snake bite victims, head trauma etc

Note that all of these patients require intensive nursing care and attention. In addition, we have emergency admission patients that frequently require life-saving measures to be instituted immediately on presentation.

A brief overview of the approach to the emergency patient is presented, followed by a systems approach to critical care nursing.

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INITIAL CLIENT CONTACT

Critical care nursing of emergency admissions begins with telephone advice. Any patient that has suffered any form of trauma, is assumed to be in cardiovascular shock until proven otherwise, and requires immediate veterinary assessment.

Likewise, snake bites, gastrointestinal disorders, disorders of mentation, and disorders of urination (especially in cats) among other conditions, all require immediate veterinary assessment on the basis that they are all potentially lethal conditions.

The nurse is frequently responsible for the extraction of information from the client, and dispensing essential first aid advice. This topic will be covered in another tutorial if requested.

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TRIAGE AND PRIMARY SURVERY

Triage is the ranking of patients for treatment according to the severity of their illness, and the presence or absence of life-threatening abnormalities.

The process of triage is carried out as follows

all trauma patients, those suspected of having a gastrointestinal accident (GDV), suspected envenomation, and all patients with altered states of consciousness are taken directly to the treatment area for immediate assessment by the ICU team

In all patients, perform a primary survey.

A primary survey is a rapid clinical examination aimed at detecting the presence of life-threatening abnormalities.
The primary survey should not take more than 1 minute to perform.

Life-threatening abnormalities are most commonly associated with disorders of airway, breathing, circulation (incl. shock), and neurologic status following this initial evaluation, the patients injuries are classified according to the immediate threat to life they pose, and the patient prioritized for treatment.

EMERGENCY PATIENT MANAGEMENT POST TRIAGE

Following triage, the patient is either scheduled for a consultation at the earliest convenience, or treatment is initiated immediately in the emergency treatment area.

In all cases, treatment should be directed at the patients most life-threatening injuries.

A brief description of the approach to disorders of airway, breathing, and circulation is as follows:

AIRWAY—ENSURE THE PATIENT HAS A PATENT AIRWAY

- provide supplemental oxygen via flow past, mask, ET tube, or oxygen
cage

- intubation reduces the chances of aspiration of gastric and oral secretions, and
should be performed if the patient has depressed gag reflexes

BREATHING

- if patient is comatose, intubate and provide supplemental oxygen

- if the patient is semicomatose, the patient should be anesthetized, intubated, and provided with supplemental oxygen. airway equipment should be ready

- if patient is conscious, provide oxygen if ventilation appears adequate; if the patient is not ventilating adequately, anesthesia and intubation should be performed

- when ventilating the emergency patient, mild hyperventilation is beneficial. The ventilatory rate in emergency patients should be 30-60/min. Mild hyperventilation may decrease cerebral blood volume by as much as 36%, whereas hypoventilation or inadequate ventilation may increase cerebral blood volume by as much as 170%. This has obvious consequences in terms of intracranial pressure

CIRCULATION

- control of bleeding - apply a soft, absorbent dressing to any site of external bleeding—apply moderate pressure bandage the area if possible. Any applied bandages should be snug, but not tight. If the bandages become soaked with blood, do not remove them, but apply more absorbent bandaging to the area.

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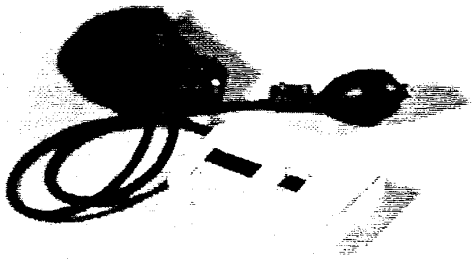
Remember, a 10cm x 10cm swab will contain 10 ml of blood when it is soaked.

-fluid therapy - the aim of fluid therapy is to provide normal, or preferably slightly supranormal levels of tissue oxygen delivery. Achieving a PCV of 28, Hb of 10 g/l, and normal cardiac output through the use of isotonic crystalloid fluid therapy, HTS/dextrans, and blood products, and control of hemostasis will achieve this aim in most patients.



NEUROLOGIC ASSESSMENT - disorders of mentation will be covered in more detail in another tutorial.

Suffice to say, we need to do 3 things in the emergency situation with respect to altered states of mentation or behavior

(i) avoid trauma to the handler - choose catheter sites that are away from the patients head eg. lateral saphenous or medial saphenous veins. Exercise caution when moving these
patients, as their responses to the environment may be unpredictable

(ii) avoid trauma to the patient - be mindful of the environment of patients with altered states of consciousness, and take measures to decrease the incidence of inadvertent self trauma by the patient. For example, placing towels or blankets around the edges of the patients cage, wrapping the patient in a blanket, removing sharp objects from the patients
Environment

Patients with head trauma, or evidence of raised intracranial pressure should have their head elevated no more than 30 degrees above the horizontal plane to aid venous drainage from the head. Elevation of the head to a level greater than 30 degrees may cause partial jugular vein occlusion. In addition, jugular veins should
not be used for blood collection

(iii) avoid stress - patients with abnormal mentation need to be handled in a quiet, calm environment. Stress to the patient, and a noisy environment raise intracranial pressure of the patient (and the emergency centre staff)

When a patient is admitted to the treatment area, the team approach is used to evaluate the patient, with the veterinarian and nurse working together to both identify patient problems, and stabilize the patient.

Much of the basic approach to immediate patient stabilization has been described above. However, underlying the team approach is the requirement to anticipate the needs of the patient, AND other team members. It is therefore important for every member of the critical care team to be familiar with treatment protocols for common emergency situations.

Part of the stabilization and initial treatment of the emergency patient involves establishing an emergency database.

This is a baseline set of values from the patient obtained on admission.

The emergency database involves a hands-on approach to achieve the following

- temperature
- pulse - rate, strength/quality
- capillary refill time, mucous membrane color
- respiratory rate, effort required, chest wall movements etc (see later)
- PCV/TP, glucose, urine specific gravity
- presence of any odours—eg uremic breath, etc

Record keeping is all important - ICU charts should be used to keep a thorough and complete record of our patients progress. The charts should provide ample space for recording the patient problem list, results of serial examinations, and for comments on patient progress.

On admission, the ICU chart needs to be filled out with the patient label, presenting condition, initial TPR, catheter sites recorded, and comments on the patient status on arrival, together with any diagnostic and therapeutic procedures carried out.

In addition, the patient weight and nutritional requirements (in kcal/day) should be calculated and recorded on admission - even if the patient is initially to receive nil per os for a period of time.

Each change in patient condition should be recorded, and the patient status relayed to the veterinarian on duty, along with your suggestions for improved treatment.

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HOW DO I TREAT THE CRITICALLY ILL PATIENT?

Treatment of critically ill patients should be carried out in a systematic fashion. The presence of trauma or disease causes inflammation. Where inflammation involves a systemic, or whole body response, it is called **"systemic inflammatory response syndrome" or SIRS**.

Patients with serious illness or inflammation require intensive nursing and management if they are to survive. This nursing and management is achieved by considering each individual organ system during the course of each TPR. The general approach is outlined below.

CONTROL THE INFLAMMATORY PROCESS

In general, the presence of a disease that results in excessive inflammation will cause damage to body organ systems, and, if left untreated, will result in patient death. Control of the focus of excessive inflammation is therefore essential to the management of many of our patients

· in surgical diseases such as GDV, or pyometra, surgery should be performed as soon as the · patient has reached hemodynamic stability, in order to remove damaged or necrotic tissue

· in bacterial diseases, commence antibiotic therapy. There is often a 2 day lag period between · initiation of antibiotic therapy, and clinical improvement in the patient

Patients with serious illness or inflammation require intensive nursing and management if they are to survive

In other diseases such as canine parvovirus, or pancreatitis, no definitive treatment is available, and close attention must be paid to the other principles of treatment of critically ill patients in order to maintain the patient until the primary disease resolves.

It should also be noted that the inflammatory cascade can be self perpetuating, despite removal of the inciting cause. For example, a bitch with a pyometra may have an ovariohysterectomy, but still may develop SIRS and critical illness following surgery.

NURSING OF THE CRITICALL ILL PATIENT

(i) fluid balance

Shock - the shock found in critically ill animals is frequently a combination of three forms of · shock -*

- hypovolemic shock - results from loss of fluid out of blood vessels into areas such as the abdominal cavity, the chest cavity, out of wounds, and into the interstitial space between cells

- distributive shock - initially in shock, stimulation of the sympathetic nervous system results in blood being shunted away from the gut, liver, kidneys skin, and pancreas. Within one hour of this occuring, these organs begin to suffer oxygen deprivation, which results in vasodilation in these organs, and redistribution of blood away from the heart, lungs, and brain, with the net result being that the vascular capacity of the body becomes greater than the blood volume available to fill the blood vessels.

* cardiogenic shock cardiogenic shock - initially in critical illness, there is an increase in cardiac output, due to increased sympathetic nervous system stimulation, which is followed by a decrease in cardiac output due to the development of distributive shock as described above and the actions of chemicals involved in tissue inflammation.

In addition, there is a decrease in systemic vascular resistance, i.e. blood pressure; due to blood vessel dilatation and increasing permeability of blood vessels - both of which are side effects of tissue inflammation. This causes extravasation, or loss of fluid out of blood vessels.

This means less blood reaches the heart, which results in a decreased ability of the heart to beat effectively

Intravascular volume deficits, or shock deficits, must be restored immediately - HTS/dextrans, isotonic crystalloids are appropriate for initial resuscitation. Synthetic colloids such as pentaspan or dextran 70 can cause a prolonged clotting time, and should not be used in a patient with a bleeding disorder.

It is important to do an Activated Clotting Time (ACT) before using dextrans or pentaspan

- **INTERSTITIAL VOLUME** - loss of fluid into third body spaces may result in interstitial and · intracellular volume depletion. Interstitial volume deficits

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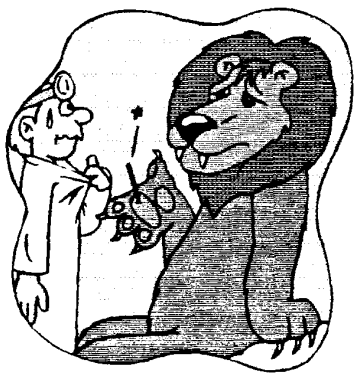
must be replaced with an isotonic solution eg. Lactated Ringers Solution, over 1-6 hours

Use of colloids colloids will reduce the volume of administered fluids by 40-60%, and also reduces the amount of fluid that leaks out of blood vessels into vital organs such as the lung. It is important to note that restoration of blood volume using shock fluid therapy may not result in a normal blood pressure, or normal pulses. This is because the heart muscle can become less responsive to fluid supplementation during serious illness. This can result in pulmonary edema in some patients, particularly cats.



(ii) **ONCOTIC PULL**—Colloid Oncotic Pressure - plasma proteins exert a force called "colloid oncotic pressure" which is a force that effectively holds water or fluid within blood vessels, and helps to stop this fluid from leaking into body tissues. Proteins can exert this effect because they do not diffuse readily through capillary membranes because of their size. Plasma proteins account for 60% of the total plasma Colloid oncotic pressure, with albumin exerting 75% of the COP exerted by proteins. The remaining 40% of COP is accounted for by an effect called the Donnan Effect - which is the effect generated by proteins attracting ions (mainly sodium), which increases the number of osmotically active particles within the blood vessels. Red blood cells exert little or no osmotic effect. The colloid oncotic pressure is essential in maintaining normal blood flow around the body

General guidelines for optimising colloid oncotic pressure are as follows

Albumin levels should not persist below a value of 20 g/l, and require protein transfusion. Albumin · should be maintained above 23 g/l

Administer synthetic large molecular weight colloids when it is anticipated extravasation of ·serum proteins will occur, resulting in loss of colloid oncotic pressure within blood vessels.

Why would proteins leak out of blood vessels? - In severe illness, or inlfammation, effectively we get 'holes' forming in our blood vessels that are large enough for serum proteins to leak through.

Administering synthetic colloids that are bigger than albumin, (and hence cannot leak out of · blood vessels as easily) before before an increase in vascular permeability occurs can prevent peripheral and pulmonary edema, and retain intravascular volume

colloids administered include pentaspan, dextran 70, plasma and plasma bi-products ·

doses - synthetic colloids 10-20 ml/kg IV q 12-24 hours ·

doses - plasma - to effect, to achieve albu min > 23g/l, 10 ml/kg IV q 12 - 24 hours ·

(iii) blood glucose - should be maintained between 3.5 - 6.5 mmol/l

Why? - both high and low blood glucose can be detrimental to critically ill patients.

Hypoglycemia · may occur very rapidly in critically ill patients, particularly those with changing clinical condition/status, and this necessitates frequent monitoring (at least once or twice daily)

(iv) electrolytes - calcium, potassium, sodium, chloride, acid base balance; should all be measured daily, and corrected where appropriate.

Why?

Decreases in serum potassium cause the following

- metabolic acidosis

- muscle weakness, gut stasis contributing to intestinal ileus and gastroparesis - vomiting!

-respiratory muscle paralysis

- ventricular arrhythmias

- carbohydrate intolerance, impaired insulin release, weight loss ·

Hyperkalemia causes the following

muscle tremors, followed by muscle weak ness

bradycardia, ventricular fibrillation, and death

Hyponatremia causes

cell swelling and cell death ·

most symptoms seen involve the central

nervous system, and include seizures, de pression, mild ·lethargy, nausea, slight in

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creases in body weight

Hypernatremia causes

· cellular dehydration

· central nervous system depression

· lethargy, depression, coma, seizures

· vomiting

· death

· tachycardia, dehydra tion, weak pulses

Obviously, these lists are not exhaustive. However, the conditions outlined above underline the importance of needing to think about electrolyte balance. In addition, nearly all pateints on intravenous fluid therapy for greater than 24 hours require the addition of potassium to their intravenous fluids.

Patients on intravenous fluid therapy for longer than 24 hours also require the addition of free water to their fluid therapy regime. This is accomplished by using 0.45% NaCl + 2.5% glucose. Therefore if you see a patient in hospital on IV fluid therapy with hartmans for 24 hours - ask the question - "is this the right fluid therapy for this patient?" and raise it with the veterinarian on duty.

(v) oxygenation and ventilation

examine the patient from a distance, before auscultating the chest to evaluate the pattern, rate · of respiration, and any exaggerated effort in either inspiration or expiration.

A PROLONGED INSPIRATORY EFFORT is characteristic of upper airway, laryngeal, or tracheal disease (including obstructive airway disease). A prolonged expiration with or without an expiratory "grunt" or abdominal effort is suggestive of pleural space disease (pneumothorax, chest wall disease, pyo/hemo/chylo - thorax) or lung disease. Any increase in respiratory effort should be reported immediately so that appropriate action can be taken if possible

· rapid, or shallow respirations can be associated with pain from ANY source, or restrictive · pulmonary or pleural diseases, and warrants immediate evaluation

· mucous membrane color is a fair indicator of tissue oxygenation, BUT do not rely on it, because · evidence of cyanosis only occurs when tissue oxygen levels are at or below 50% of normal(!) Pulse oximetry, for all its limitations, is more reliable when used in conjunction with mm color

· special care is required with dyspnoeic pateints, and they should have minimal handling and restraint to avoid stress-induced respiratory arrest (esp cats, and puppies)

· any patient that has depressed mentation, depressed swallowing reflexes, or is vomiting or ·regurgitating is considered at risk for developing aspiration pneumonia, and should be on antiemetics (metoclopramide) and have appropriate postural support (towel under the scapula allows regurgitated material to flow out the mouth, rather than into the airways) Nasogastric suctioning should also be performed in these patients every 2-3 hours

· always provide supplemental oxygen
· measure blood gases q 12 hours, pulse oximetry q 4 hours

· failure to maintain SpO2 despite oxygen supplementation is an indication for providing ventilatory · assistance +/- positive inotrope use

ARDS - acute respiratory distress syndrome is a complex respiratory disease which results from systemic inflammation in the body causing leaking capillaries in the lungs. As we mentioned briefly in the section on fluid therapy, one of the side effects of widespread tissue inflammation is the release of the chemicals, or mediators of tissue inflammation into the systemic circulation. When this happens, we see evidence of a severely sick animal. When these inflammatory mediators reach the lung, they cause destruction of the lung capillary membranes. This allows fluid and proteins (including albumin) to leak out of the capillaries, and into the lung tissue.

This is **BAD** - fluid in your lungs decreases the effectiveness of gas exchange....this impairs the oxygenation of your tissues.

ARDS may also result from direct trauma, fat emboli released from long bone fractures, sudden
increase in sympathetic discharge resulting in pulmonary hypertension in head trauma/electric
shock, and aspiration pneumonia.

Part II will be in the next edition of Veterinary Nursing In New Zealand.