Additional information to accompany presentations

PACU Learning and Teaching Resource
CIRCULATION : ASSESSMENT

Presentation: Circulatory assessment

Circulatory Assessment :

- Skilled cardiovascular assessment is vital to inform treatment. Assessment of physical signs by direct observation [colour, level of consciousness, urine output], and feel [radial pulse, skin, peripheral warmth] will give an immediate indication of CVS on patient arrival and ongoing status. Once monitoring has been set up HR, BP, $Sa0_2$, temperature provide essential data for assessing clinical status.

- Observations of BP, HR, RR, $Sa0_2$ are taken routinely every 10-15 minutes and recorded or more often if the clinical condition deteriorates. Observe trends rather than individual readings. Look for small, early warning signs : the raised heart rate, fall in $Sa0_2$. BP can be maintained by homeostatic mechanisms and appear satisfactory while actually the patient is severely hypovolaemic and will soon become hypotensive.

- Note: in advanced practice : CVS is further assessed by monitoring systems which monitor Stroke Volume, Cardiac Output, and SVR allowing precise CVS management.

- Critical assessment entails judging the patient's actual presentation with an estimation of the potential for CVS complications. Risk factors include patient age, previous medical history, anaesthesia delivered and surgical intervention. Risk analysis enables the practitioner to plan treatment to avoid risks becoming complications. If a risk has already become a complication it informs analysis of the underlying reason in order to correct. This is not always possible. Events happen fast, and often intervention immediately follows observation of physical and vital signs.

Physical and critical risk assessment

- We will consider now in turn the signs of normal cardiovascular activity and how these may be deranged along a continuum from normal, to abnormal to severe abnormality. Two points should be emphasized here:

    a. always check on the patients preoperative status [BP: HR : Temp]
    b. always check the trends [i.e. during the surgery and into the post anaesthetic period]

- **Airway, Breathing** : always assess airway as first priority. Is airway patent or obstructed [please see Airway module]. Breathing : is it regular, of sufficient volume [please see Breathing module]. Obstructive breathing, respiratory insufficiency can lead to compensation by the CVS [increased HR and BP]. Likewise severe hypotension can be accompanied by compensatory tachypnea as the patient attempts to load more oxygen into the diminished blood supply.

- **Level of consciousness** : while unconscious the airway needs to be protected**.** When coming round the patient's sympathetic nervous system is fully activated and pain may be felt. This can be a risky period while there is still derangement of cardiovascular function.

- **Mental status :** if the patient is awake, alert, orientated, this denotes that the blood flow to the brain is sufficient to supply oxygen. In the awake patient, signs of disorientation, anxiety, restlessness may denote hypoperfusion and hypoxia to the brain. However, for the recovering patient mental status may be difficult to assess when the patient is coming round from anaesthesia and maybe disorientated, confused, restless and anxious. Again the patient may display these signs as a result of pain.

- **Blood pressure :**. it should be noted immediately that there is no 'normal' BP for the individual : BP is very individual but 120/80 or less is considered average for the adult at rest. Consideration of the pre-operative BP is very important. Again BP must be considered along with HR and other physical signs [including peripheral perfusion]. Even if there is moderate

hypotension, if the patient is alert, orientated, good colour with warm peripheries there is clearly no real problem with cardiovascular status.

- **Mean arterial pressure [MAP] :** this 'average' of systolic and diastolic pressures is being used more now in clinical practice. A MAP of between 70 to 100mmHg is considered normal. To calculate this the diastolic BP is doubled and added to the systolic. That composite sum is then divided by 3 to estimate MAP. This is automatically calculated electronically now.

- **Pulse deficit :** is the difference between the systolic and diastolic pressure and gives an indication of the state of the heart. If very narrow, with a raised diastolic pressure – this could denote a potentially serious cardiac stress – as the ventricle is forced to work hard in ejecting stroke volume into the aorta. In patients with cardiac disease this can *****

- **Hypotension :** indicated by low BP. Physical assessment will pose questions such as : is this BP a one off, or is there a trend here? Are the peripheries well perfused or shut down? If there is a degree of peripheral shut down, accompanied by low peripheral/central temperature does the patient need warming and filling? is there a reflex tachycardia? is this tachyardia related to fluid depletion of stress caused by pain or anxiety? If fluid related, what is the urine output? These facts will alert the nurse how serious is the patient's hypotension, and inform the nature and speed of intervention.

  Critical assessment : *evidence from the anaesthetic chart is key to establishing the likely cause of hypotension and the best course of action. The fluid record will establish whether there is fluid depletion. Use of spinal or epidural will cause vasodilation a likely cause of low blood pressure. Anaesthetic drug combination could explain moderate residual hypotension. Evidence of cardiac history may alert to the possibility of myocardial injury.*

- **Hypertension :** Indicated by BP. Checking the preoperative BP will give an immediate indication whether the BP is normal for the patient. Causes will be sought : pain, anxiety, overfilling being obvious contributory factors.

- **Heart rate and rhythm:** HR is a valuable sign that increases understanding of CVS. Remember CO = SV X HR. HR is considered along with BP and together they give a better understanding of CVS status. Fast HR, low BP indicates hypovolaemia. Normal heart rate falls between 60 -100 bpm. Heart rates of above 100 [tachycardia] and below 50 [bradycardia] should be investigated. Critical analysis of factors will help assess these situations : are they caused by drugs, pain, anxiety, pyrexia? Above all, is bradycardia compromising the BP?

- **Heart rhythm :** ECG standard monitoring will reveal much information about the activity of the heart. Normal sinus rhythm demonstrates a 'p' wave falling prior to each 'qrs' complex which indicates that the primary pacemaker – the SA node is functioning. Sinus tachycardia and bradycardia also indicate that the beat originates in the SA node.

- **Common arrhythmias** include atrial fibrillation where the atria contact from multiple points which in the atria and appear as fibrillatory waves on the ECG rather than 'p' waves. Ectopic foci on ECG are large, bizarre 'qrs' complexes which indicate that the ventricles are stimulated from outside normal conduction system.

  Critical assessment*: how significant is this – do they appear infrequently – or are they compromising BP? what is the cause [due to hypoxia – electrolyte imbalance?]. Does the arrhythmia require treatment?*

- **Central Venous Pressure :** invasive monitoring of CVP for more complex cases provides information on venous return -the fluid status of the patient where fluid management is critical. Cannula is placed in the right atrium via the superior vena cava. Normal values 3-8mmHg. Values should be interpreted alongside BP and HR. Normal circulatory function will be denoted by normotension, regular HR and CVP within limits.

  Critical assessment *: lowered CVP may be accompanied by raised BP and HR – indicating fluid deficit. Raised CVP by fluid overload. Careful examination of fluid status, pre and intra operative will reveal more. NB if there is no CVP line in situ – raising the legs will indicate if hypotension is caused by underfilling as venous return and BP is boosted.*

- **Temperature : central and peripheral :** Normal core central temperature is 37C while peripheral is around 29C. Peripheral monitoring is not routine for most PACU units. Normal readings indicate that the patient is warm and well perfused, and that therefore the CVS is working well to deliver blood to the peripheries.

- While there is often a residual rise in central temperature due to surgical stress, pyrexia [due to sepsis, infection] is not so common in PACU. **Malignant Hyperpyrexia** is a known complication of anaesthesia resulting in a massive rise of core temperature. It is a medical emergency and must be treated immediately with dantrolene, a drug found in all units.

- **Hypothermia** is a complication of general anaesthesia however with core temperature dropping to as low as 34C. If vasoconstriction accompanies hypothermia then care must be taken to warm and fill the patient gradually. Warming too fast with inadequate filling will result in vasodilation and a fall in blood pressure.

  Critical assessment *: to what extent is hypothermia significant? Hypothermia below 36C can significantly delay recovery affecting many systems and should be treated. Surgery on the abdomen can involve prolonged exposure reducing core temperature. Elderly lose heat quickly. Those with cardiac history could be prone to cardiac instability due to hypothermia. As risk factors increase, so the need for urgent intervention increases.*

- **Peripheral temperature** denotes perfusion : if cool, vasoconstricted has taken place. If this accompanies severe hypotension and skin becomes moist and clammy to touch then the patient is in shock. Warm, well filled peripheries indicate stable CVS.

- **Patient colour** : pink mucous membranes of the lips and conjunctivae denote normal perfusion. Bluish mucous membranes denotes central hypoxia. Peripheral perfusion is indicated by the colour of distal tissues : if bluish or mottled this may indicate peripheral vasoconstriction especially if feet are cold.

- **CSM [colour, sensation and movement]** : this can be useful in assessing circulation. Do the distal finger nails pink up rapidly after pressure release [less than 1 sec] : is sensation present in all fingers? – do all digits move?. Failure of any one of these may infer circulatory problems.

- **Skin turgor :** the feel of the skin is a valuable tool in assessment. Normal perfusion is indicated by a dry skin along with other signs. If pinched, the skin should spring back immediately. If the patient is hypovolaemic it takes longer to fall back. Clammy, wet, moist, cold skin feel denotes serious CVS impairment and shock. Vasoconstriction of the peripheral vessels causes this.

- **Urine output :** provides valuable information about CVS efficiency. In the catheterized patient, hourly urine measurement reflects kidney perfusion. Normal urine output for the adult is 0.5ml/kg/hour. This denotes that the blood pressure is sufficient to drive the kidneys to create urine. If hypotension is significant this is denoted by diminished urine output – and concentrated urine.

  Critical assessment : Urine output must be assessed for significance alongside other CVS measurements. An appraisal of the total fluid balance status of the patient must be completed : examine the preoperative history and intra operative fluid loss and replacement.

  All of the above physical signs and monitored information must be considered together in arriving at an accurate assessment of the CVS status of the patient.

Trainer’s notes on power point presentations

Circulation : Assessment

Assessment Presentation

Slide 3. While checking airway and breathing, a look at patient colour, $Sa0_2$ and a quick feel of peripheries [feet/hands] will give you an immediate indication of CVS status even before the blood pressure cuff is applied.

4-5: Gathering information at handover is a skill, there is so much going on. However the experienced nurse plans care as she receives information. Knowing the patient age, operation, time in theatre, nature of anaesthetic will already have allowed her to perform an initial 'risk' assessment. Discuss with the group the challenges of receiving a patient, setting them up, taking a handover and starting to plan care.

7-8: Physical & monitoring assessment are shown here on two separate slides. Emphasise how useful monitored [hard data] is in assessing the patient, but also how important it is to hone physical assessment skills [especially if monitoring systems let you down!]

9 : serves as a reminder about what normal CVS function looks like.

10-11 : Airway, breathing assessment by now very familiar to students. Always the priority however.

12: Mental status. A discussion around the difficulty of assessing mental status in the immediate post operative period would be useful here. Anxiety, confusion are clearly classic signs of hypoxia, which could be caused by hypoperfusion. This is a very important sign of CVS stability. However, there are many others reasons for these signs when waking up post general anaesthesia. A short discussion on this would be beneficial.

13-14 : Blood pressure [together with HR] are key indicators of CVS stability. Stress that there is while there is a range of normal blood pressure, every patient's blood pressure derives from many factors pertinent to that individual.

Preoperative baseline BP is essential information. Stress again that BP trends are useful rather than the one off reading. Also the relationship between BP reading and physical sign or other vital signs must be considered. It is the blood pressure along with mental status, perfusion, urine output and so on.

15-16: Mean arterial blood pressure is being used increasingly in clinical practice bringing together both systolic and diastolic flow pressures. Pulse pressure is significant as an indicator of cardiac distress. If narrow indicates increased afterload resistance to ventricular contractions. Useful guide from Hatfield and Tronson here on slide 16.

17-19: Brady and tachycardia have been discussed in Basic Sciences. Both are harmful to CVS homeostasis. The cause of either must be found and corrected.

20: Heart rhythm : again discussed in Basic Sciences. Arrythmias can compromise circulation.

21: Monitoring data of BP + HR + CVP must be considered along with physical signs : if BP is satisfactory but CVP low with diminished urine output – suspect that this is early shock. The BP continues to hold up with sympathetic stimulus but this will not last. Continue to closely observe, feel for peripheral warmth.

22: Feel of radial pulse. This can reveal much information : is it thin and thready, or full and bounding indicating adequate filling. An Irregular pulse may reveal atrial fibrillation.

23: Central venous pressure : provide data to reveal the right atrial filling pressure an indication of volume. This measurement indicates the need for filling – or indeed if the patient is over filled.

24-25 : Temperature : core temperature is important. Hypothermia can lead to cardiac instability as can hyperpyrexia [malignant hyperpyrexia is a rare event that can be life threatening]. Peripheral vasoconstriction due to hypothermia can lead to lactic acidosis. Peripheral temperature is a key way to assess vasoconstriction. If the patient is warm to toes this

is an indication that circulatory homeostasis has been achieved. Similarly cold, clammy extremities are key indicators of profound vasoconstriction and shock.

26 : Colour also indicates perfusion. Central cyanosis [bluish lips] is caused primarily by hypoxia. Peripheral cyanosis [mottled extremities] is only caused by circulatory failure.

27 : Skin turgor : warm, dry skin indicates circulatory health. Patients who are underfilled display dry, crinkled skin which does not rebound on pinching. Damp, moist skin key indicator of circulatory shock.

25 : Fluid balance : urine output is a key indicator of circulatory health. If urine output falls, this means that the arterial pressure driving the glomerulus to form urine is failing. This may be assessed prior to a fall in BP.
The overall fluid balance of the patient is vital information to inform the nurse of circulatory risk, and problems. All input and output sources [i.e. including naso-gastric secretions] should be included.

30-36 : Critical risk factors are given over the next few slides. All are familiar from previous modules [airway and breathing]. All demonstrate the many factors that can challenge the cardiovascular system post anaesthesia and surgery. Understanding risk factors however informs clinical assessment and enables appropriate intervention.

37: One last thought, having discussed the use of risk analysis at length, we conclude that if events are happening fast, the patient is deteriorating, there is no time to fully analyse the causation – intervention must be swift and based around the physical presentation.