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HEMODYNAMIC MONITORING AND MEDICATION ADMINISTRATION FOR PATIENT RECEVING VASOPRESSION IN ICU

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ABSTRACT:

Hemodynamic monitoring involves using invasive and non-invasive methods to gather information about a critically ill patient's cardiovascular functioning for diagnosis and treatment guidance. hemodynamic instability can be the result of hypovolemia or cardiac or vasomotor dysfunction, which can lead to organ dysfunction, multi-organ failure, or death. non-invasive monitoring includes manual bp, electrocardiogram, temperature, respiratory rate, pulse oximetry, and urine output. Arterial catheterization. vasopressor and inotropic drugs act quickly, so invasive bp monitoring, typically by arterial catheterization, may be required to safely titrate vasopressor and inotrope infusions. arterial catheterization also provides access for diagnostic laboratory blood testing. central venous catheterization central venous catheterization (cvc) allows for central venous access using one of three options: the internal jugular vein, common femoral vein, or subclavian vein. cvc is used for multiple infusions, if peripheral access can't be obtained, and to administer medications that may be caustic to tissues when given via peripherally inserted catheters. Pulmonary artery catheterization Pac (swan-Ganz catheter) has been the gold standard for cardiac output monitoring for nearly 50 years, primarily in cardiac surgery patients. the pac is inserted through a central vein (femoral, jugular, antecubital, or brachial) and advanced through the right side of the heart to the pulmonary artery. it's used to measure intrathoracic intravascular pressures in the right atrium (central venous pressure), pulmonary artery, and pulmonary veins (pulmonary wedge pressure). a pac is particularly helpful in patients with right ventricular dysfunction or pulmonary arterial hypertension. vasopressor and inotropic infusion titration when the initial vasopressor or inotrope has been selected based on the underlying cause of shock, titrate the dose to achieve sufficient blood pressure or end-organ perfusion indicated by the map, as ordered by the provider. the most common target for vasopressor and inotropic titration is a map value of 60 mmhg to 65 mmhg. conclusion. hemodynamic monitoring and vasopressor and inotrope administration and titration are essential to ensuring sufficient tissue oxygenation and end-organ perfusion. your knowledge of anatomy, physiology, and pharmacology, along with competent assessment skills, can ensure a safe outcome for your patients.

KEY WORDS:

Hemodynamic monitoring, instability, vasopressor, inotropic.

INTRODUCTION:

Hemodynamic monitoring involves using invasive and non-invasive methods to gather information about a critically ill patient's cardiovascular functioning for diagnosis and treatment guidance. Hemodynamic instability can be the result of hypovolemia or cardiac or vasomotor dysfunction, which can lead to organ dysfunction, multi-organ failure, or death. Non-invasive monitoring includes manual BP, electrocardiogram, temperature, respiratory rate, pulse oximetry, and urine output.

Invasive monitoring includes inserting an arterial line for continuous BP measurement and arterial blood gas analysis, and central venous catheterization or pulmonary artery catheters (PACs) for advanced hemodynamic monitoring to guide fluid resuscitation and the need for vasopressors or inotropic infusions.

Both invasive and non-invasive monitoring are helpful for assessing patients' responses to medications, so that titration is effective. Here is a closer look at invasive techniques used for monitoring and medication administration.

ARTERIAL CATHETERIZATION:

Vasopressor and inotropic drugs act quickly, so invasive BP monitoring, typically by arterial catheterization, may be required to safely titrate vasopressor and inotrope infusions. Arterial catheterization also provides access for diagnostic laboratory blood testing.

A trained provider places the arterial line using sterile technique. Radial and femoral sites are the most common, but other locations include the brachial, axillary, and dorsalis pedis artery. As the critical care nurse, you're responsible for arterial transducer setup (including levelling) line patency, hemodynamic response assessment using arterial waveform interpretation, and insertion site care. Transducer setup requires tight tubing and catheter connections, a pressure bag set at 300 mmHg to maintain system patency, and a transducer levelled to the phlebostatic axis. The phlebostatic axis is located at the convergence of a vertical line drawn from the fourth intercostal space to the right of the sternum midway from the anterior to the posterior chest. Mark the site to ensure consistency for accurate pressure readings. Transducer levelling should be performed every shift or whenever a data discrepancy occurs.

The arterial line is a continuous measurement of heart rate, BP, systemic perfusion, MAP, pulse pressure, and pulse pressure variation. Arterial waveforms represent left ventricular pressure during systole and consist of three components: systolic phase (steep rise in arterial pressure from the lowest point to the peak), dicrotic notch (closure of the aortic valve), and the diastolic phase (lowest point).

The Square Wave Test ensures accuracy of the hemodynamic values. It's performed by opening the continuous flush valve to a high-pressure signal, invoking transducer vibration from a "fast flush." If the waveform is adequately dampened, only two oscillations follow the flush with a subsequent clear arterial waveform and a visible dicrotic notch.

Waveform dampening also can result from kinked or obstructed cannulas, loose connections, and air bubbles within the tubing or transducer, resulting in false low or high readings. Inaccurate and misinterpreted waveforms can affect infusion titrations and clinical endpoints.

Arterial line complications include severe blood loss, local or systemic infections, arterial thrombosis, air embolism, and accidental medication injection. (See Arterial line complications and nursing considerations.)

CENTRAL VENOUS CATHETERIZATION:

Central venous catheterization (CVC) allows for central venous access using one of three options: the internal jugular vein, common femoral vein, or subclavian vein. CVC is used for multiple infusions, if peripheral access can't be obtained, and to administer medications that may be caustic to tissues when given via peripherally inserted catheters.

Vasoactive infusions through a peripherally inserted venous catheter may cause severe tissue injury and necrosis with infiltration. Controversy exists over the absolute need for a central venous catheter instead of a peripherally inserted one to administer vasopressor and inotrope infusions. Considerations include drug concentration, infusion rate, and duration. However, the absence of central access shouldn't hinder the initiation of these drugs, as failing to initiate therapy promptly could result in detrimental effects to the patient. If central access isn't available, initiate the infusion at the lowest rate and concentration necessary to achieve directed hemodynamic goals, and carefully monitor the peripheral site.

If infiltration is suspected, immediately discontinue the infusion, aspirate any residual fluid from the catheter, irrigate the line with saline, elevate the affected area, apply warm or cold compresses per protocol, and notify the pharmacy and provider. Pharmacologic treatment for infiltration of vasopressors and inotropes includes subcutaneous administration of 5 to 10 mg of phentolamine mesylate in 10 mL of saline around the infiltration within 12 hours of extravasation to prevent local ischemia.

To prevent intravascular catheter-related infections, the Centre's for Disease Control and Prevention recommends using aseptic technique when changing dressings and prompt removal when the catheter is no longer needed.

PULMONARY ARTERY CATHETERIZATION:

PAC (Swan-Ganz catheter) has been the gold standard for cardiac output monitoring for nearly 50 years, primarily in cardiac surgery patients. The PAC is inserted through a central vein (femoral, jugular, antecubital, or brachial) and advanced through the right side of the heart to the pulmonary artery. It's used to measure intrathoracic intravascular pressures in the right atrium (central venous pressure), pulmonary artery, and pulmonary veins (pulmonary wedge pressure). A PAC is particularly helpful in patients with right ventricular dysfunction or pulmonary arterial hypertension.

Routine PAC site care requires following organization policy for sterile dressing changes and documenting catheter placement and signs and symptoms of site infection. The catheter's sterile sleeve integrity must be maintained to allow catheter movement without contamination. In addition to site care, monitor for dysrhythmias, check waveform and hemodynamic values, oversee patient activity and positioning, and remove the catheter as ordered.

Assessing patients with a PAC is essential for preventing and identifying potential complications, including balloon rupture, dysrhythmias, air embolism, pulmonary thromboembolism, pulmonary artery rupture, and infarction. Review daily chest imaging to check catheter position, and zero and level transducers after repositioning. Spontaneous balloon wedging is life-threatening and requires immediate intervention. Ensure the wedging syringe isn't full of air or accidentally inflated and that the balloon is deflated.

VASOPRESSOR AND INOTROPIC INFUSION TITRATION:

When the initial vasopressor or inotrope has been selected based on the underlying cause of shock, titrate the dose to achieve sufficient blood pressure or end-organ perfusion indicated by the MAP, as ordered by the provider. The most common target for vasopressor and inotropic titration is a MAP value of 60 mmHg to 65 mmHg.

Continuous vasopressor/inotropic infusions must be administered via infusion pump to prevent interrupted flow, unexpected changes in flow rates, and undesired boluses. Vasopressors have a short half-life and duration of action, so they require continuous infusion and rapid titration, usually every 5 to 15 minutes. You want to find a balance between hemodynamic stability and adequate perfusion while using the minimum dose needed. When hemodynamic stability has been achieved, begin weaning vasopressors to facilitate the lowest dose required to maintain the desired effects.

Your familiarity with organizational and unit titration policies will help ensure patient safety and reduce medication error and adverse event risks. Smart pumps can help reduce medication errors, but you must calculate and verify infusions before administration and confirm minimum and maximum doses.

CONCLUSION:

Hemodynamic monitoring and vasopressor and inotrope administration and titration are essential to ensuring sufficient tissue oxygenation and end-organ perfusion. Your knowledge of anatomy, physiology, and pharmacology, along with competent assessment skills, can ensure a safe outcome for your patients.

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