

MANAGEMENT OF CRISES DURING ANESTHESIA AND SURGERY. PART I: HYPOTENSION & HYPERTENSION

Salam N Asfar[@] & Jasim M Salman[#]

[@]MB, ChB, MSc, Professor of Anesthesiology, College of Medicine, University of Basrah, Basrah, Iraq.

[#]MB, ChB, DA, Consultant Anesthesiologist, AlSadir Teaching Hospital, Basrah.

Hypotension

Hypotension could be defined as a blood pressure low enough to cause signs and symptoms of inadequate blood flow to the vital organs. A blood pressure less than 90/60 mmHg is sometimes considered the cutoff for hypotension but this may be a perfectly acceptable value in some people.

Hypotension also considered if a patient under general anesthesia have a drop in blood pressure greater than 20% of his normal baseline. You may see changes in the ECG (ischemic; such as ST segment depression or elevation), pulse oximeter (hypoxia), heart rate (reflex tachycardia) and end-tidal CO₂ (decreased secondary to a decreased cardiac output state).

Hypotension is commonly encountered during anesthesia and may be mild and self-limiting. Sustained uncorrected hypotension has the potential to impair organ perfusion to such a degree as to result in irreversible ischemic damage. When vital organs are involved, the result may be permanent neurological deficit, cardiomyopathy, or renal impairment.

In the pregnant patient, the wellbeing of the fetus may be compromised. In the acute setting, profound hypotension may herald or precipitate a cardiac arrest. In patients with limited cardiac reserve, even relatively mild levels of hypotension to degrees often considered acceptable with “standard” anesthetic

techniques, might be problematic in terms of myocardial ischemia. This has been exemplified with propofol associated deaths in ASA III–IV patients. Cardiac reserve may also be reduced in patients with sepsis, renal disease and major trauma in addition to those with intrinsic myocardial disease.

Differential diagnosis of hypotension:

Pulmonary: hypoxia, hypercarbia & tension pneumothorax.

Hypovolemia: fluid deficit & acute blood loss.

Cardiac: rate/rhythm abnormality, inotropic failure, myocardial ischemia, contusion, tamponade, rupture, congestive heart failure, cardiomyopathy, valvular injury or lesion.

Shock: hypovolemia, cardiogenic & septic.

Surgical compression of the heart, aorta, inferior vena cava, or abdominal contents.

Embolus: pulmonary, air, fat & amniotic.

Electrolyte and hormonal abnormalities: hypoglycemia, hypocalcemia, adrenal insufficiency, anti-diuretic hormone suppression & hypermagnesemia.

Anaphylaxis: latex, transfusion, drugs such as antibiotics (pencillin, cephalosporin, sulfa, vancomycin), local anesthetic (usually an ester), muscle relaxants (atracurium, mivacurium,

d-tubocurarine, succinylcholine), opioids (morphine, meperidine), protamine, colloids, iodine & IV contrast dye. *Deep anesthesia*; drug overdose, medications such as angiotensin converting enzyme inhibitors & angiotensin receptor blockers.

Hypothermia, Sympathetic blockade, neuraxial block, Venodilation, Laparoscopy. Hypercarbia, Dysrhythmia, Increased vagal tone from excessive stretching of the peritoneum, Compression of the inferior vena cava causing a decrease in cardiac output & venous gas embolism.

Hypotension management:

1-Emergency management

Confirm the blood pressure change is real, don't hesitate to treat as Cardiac Arrest, Inform and interrogate the surgeon, Recheck vaporizers are off, Improve posture: lie flat, elevate legs, if possible.

Intravenous fluids: crystalloid bolus 10ml/kg and repeat as necessary, Give vasopressor: metaraminol 0.005–0.01mg/kg IV bolus, If severe give adrenaline 0.001mg/kg IV bolus, that is 1ml of 1:10,000, Followed if necessary by an infusion of adrenaline starting at 0.00015mg/kg/min (1ml/min of 1mg in 100ml).

If erythema, rash or wheeze is evident treat as anaphylaxis.

If bradycardic give atropine.

If pulseless treat as cardiac arrest.

If desaturated or cyanosed treat the cause.

Increase monitoring: ECG, arterial line & CVP.

2- Review and treat probable causes:

Hypovolaemia; Consider: Blood loss, dehydration, diuresis & sepsis.

Ensure: Adequate IV access, fluid replacement & cross match.

Drugs; Consider: Induction and inhalational agents, opioids, suxamethonium, anticholinesterases, local anaesthetic toxicity, vancomycin, protamine, vasopressor/vasodilator

infusion problem, drug ampoule or syringe error and drugs given by surgeon. Ensure: Agent ceased and support circulation.

Regional Anaesthesia; Consider: Vasodilation, bradycardia & respiratory failure.

Ensure: Volume loading, vasopressors (early adrenaline), airway support & left lateral displacement during pregnancy.

Surgical Events; Consider: Vagal reflexes, obstructed venous return, pneumoperitoneum, retractors and position. Ensure: Surgeon aware.

Cardiopulmonary Problems; Consider: Tension pneumothorax, haemothorax, tamponade, embolism (gas, amniotic or thrombus), sepsis & myocardial depression (from drugs, ischemia & electrolytes, trauma).

Consider; invasive hemodynamic monitoring. Use a sphygmomanometer and auscultate the blood pressure. When using an arterial line, check the zero and calibration.

Another treatment: Start bolus and/or infusion therapy of Phenylephrine, Ephedrine, Dopamine or Dobutamine. Place the patient in head-down tilt or trendelenburg position which may be of benefit.

References

1. R W Morris, L M Watterson, R N Westhorpe, R K Webb. Crisis management during anaesthesia: hypotension. Downloaded from qshc.bmj.com on May 20, 2010 Published by group.bmj.com
2. Barash PG, Cullen BF, Stoelting RK. Clinical Anesthesia, 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006, p 644.
3. Miller RD, Fleisher LA, Johns RA, et al. Anesthesia, 6th ed. New York: Churchill Livingstone, 2005, p 2716.

Hypertension

An adult whose systemic blood pressure is greater than 140/90 mmHg on at least two different occasions measured more than 1 week apart is considered to be hypertensive. Intraoperative hypertension is common and has many causes. It is

usually rapidly and successfully treated by anesthesiologist. However, when it is severe, no cause is evident or it fails to respond to routine measures, it has the potential to cause morbidity and even mortality in susceptible patients. A rapid appropriate response by the anesthesiologist to this problem is therefore required.

Causes of hypertension:

Precipitating factors: Awareness during anesthesia, Drug errors, Pre-existing hypertension, Airway problems

Surgical factors: Hypercarbia, Pheochromocytoma, Hyperthyroidism, Malignant hyperthermia, Raised intracranial pressure, Fluid overload.

Equipment related: Sphygmomanometer cuff herniation

Ventilation problems: Stuck valve, Hypoventilation, Soda lime exhaustion, Endobronchial intubation.

Drugs: Vasopressor administration: by anaesthetist or by a surgeon, adrenaline with local anaesthetic, failure to deliver volatile agent, failure to deliver nitrous oxide.

Anti-hypertensive agents options:

A. β 1- adrenergic receptor blockers such as Esmolol, metoprolol & labetalol, they decrease heart rate and peripheral vascular resistance, Avoid if heart rate is <60 beats per minute, Use with caution in asthmatics.

B. α 1- receptor blocker; Hydralazine: has a slower onset (10–20 minutes) and longer duration (2–4 hours) compared to beta-blockers. The associated baroreceptor reflex may increase heart rate and cardiac output.

C. α 2- receptor agonist; Clonidine and dexmedetomidine: Decreases systemic vascular resistance heart rate.

D. Vasodilators; Nitroglycerin is a direct vasodilator that acts on the venous system more than the arterial system. It

Sodium nitroprusside is a balanced arteriolar and venous dilator.

Management of hypertension:

Other actions:

A- Confirm the blood pressure change is real.

B- Stop vasopressors.

C- Inform and interrogate the surgeon, cease stimulation.

D- Recheck for drug errors and delivery of anesthesia.

E- Consider an appropriate dose of opioid fentanyl 0.25-0.5 mg/kg.

F- Consider antihypertensive therapy.

G- Be cautious using hypotensive agents specially if the possibility of light anesthesia.

Consider GTN 50 mg in 500 ml 5% dextrose and start at 0.1 ml/kg/hr (adult dose 5-10ml/hr) and Esmolol, α & β blocker with a rapid onset and short duration in a dose of 0.25-0.5mg/kg.

H- If tachycardia is troublesome: give atenolol 0.015mg/kg IV bolus injection.

I- Review and treat probable causes such as hypoventilation, hypercarbia, hypoxia, surgical stimulus,

J- Consider invasive blood pressure monitoring.

reduces preload, myocardial oxygen demand, and platelet aggregation.

References:

1. A D Paix, W B Runciman, B F Horan, M J Chapman, M Currie. Crisis management during anaesthesia: hypertension, Downloaded from qshc.bmj.com on May 20, 2010 - Published by group.bmj.com
2. Barash PG, Cullen BF, Stoelting RK. Clinical Anesthesia, 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006, pp 475–501.
3. Hines, Marschall. Stoelting's Anesthesia and Co-Existing Disease, 5th ed. Philadelphia: Churchill Livingstone, 2008, p 92.
4. Miller RD, Fleisher LA, Johns RA, et al. Anesthesia, 6th ed. New York: Churchill Livingstone, 2005, p. 2717.
5. Hanada S, Kawakami H, Goto T, et al. Hypertension and anesthesia. Current Opinion in Anaesthesiology 19(3):315–9.
6. Howell SJ, Sear JW, and Foex P. Hypertension, hypertension heart disease, and perioperative cardiac risk. British Journal of Anaesthesia (BJA), 2004, 92(4):570–83.