



## Intraoperative Hypotension: A Surgeon's Nightmare

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### Abstract

*Sudden intraoperative hypotension can prove to be a lethal emergency. Awareness of the possible causes and risk factors is essential to prevent this complication. Close monitoring of the patient during the procedure followed by aggressive resuscitation by a team effort can only prevent an intraoperative mortality.*

**Key Words:** *Intraoperative Hypotension Diagnosis Treatment*

### Introduction

Sudden intraoperative hypotension continues to be the most dreadful anesthetic emergency. Innumerable articles have been published on the topic with very little effect. The list of causes continues to expand but instantaneous recognition of hypotension with aggressive resuscitation can only help in preventing the morbid complications and mortality. The paper briefly reviews the possible causes for intraoperative hypotension.

### Pathophysiology

Physiologically the mean arterial pressure by definition is the product of cardiac output and systemic vascular resistance. Cardiac output depends upon the heart rate and stroke volume. This in turn is affected by a wide range of factors ranging from medications to severe blood loss. (Table 1) Systemic vascular resistance depends predominantly upon the degree of sympathetic tone and effect of vasoactive medication. (Table 2)

The pattern of anesthesia especially regional one is a significant factor which affects sympathetic tone, which could inturncan reduce blood pressure. Maintenance of optimum blood pressure during the course of surgical procedure is important in order to maintain the perfusion of vital organs like brain, heart and kidney. The hemodynamic homeostasis is maintained by multitude of auto regulatory processes. These auto regulatory mechanisms are adversely affected by comorbid medical illnesses. <sup>[1,2]</sup> As a result failure in the auto regulatory mechanisms predisposes to sudden hypotension during surgery. Awareness of these auto regulatory mechanisms and the effect of drugs upon them are important in preventing sudden intraoperative hypotension. Such accidents are a nightmare and a disaster to the operating surgeon.

**Risk factors**

Preoperative assessment of risk in patients is of utmost importance in the implementation of safe surgical practice. <sup>[2]</sup> It is safe and prudent on the part of attending surgeon to order for a battery of investigations pertaining to every vital system of body in order to pick up occult abnormalities of every system. When subjected to the stress of surgery these occult abnormalities may become manifest leading to hypotensive episodes.

**Table1** Reduced cardiac output

<b>Decreased Preload</b>	
Hypovolemia	Blood loss, GI loss, burns
Obstruction	Pulmonary embolus, aortocaval compression
Raised intrathoracic pressure	Pneumothorax, positive pressure ventilation
<b>Decreased contractility</b>	
Drugs	Anesthetic agents, B blockers
Myocardial ischemia	
Arrhythmias	
Cardiac tamponade	
<b>Increased afterload</b>	
Embolic event	
<b>Decreased Heart rate</b>	Vagal stimulation, drugs, heart block

**Table 2** Decreased systemic vascular resistance

<b>Pharmacological</b>	Regional anesthesia, Anesthetic agents, Histamine release,(atracurium)
<b>Pathological</b>	Anaphylaxis-drugs, fluids etc.  Transfusion reaction  sepsis

#### Hypertension:

Hypertension is one of the commonest causes seen in elderly surgical patients. Over the last few years the spectrum of age groups affected by hypertension has widened significantly. Hypertensive patients are more prone to hypotensive episodes perioperatively. In addition to this, certain antihypertensive medications like ACE inhibitors by themselves predispose to hypotension. So consideration should be given to omit such medications preoperatively

#### Cardiac problems:

Myocardial diseases go hand in glove with hypertension. Myocardial disease is known to weaken the physiologic reserves of heart thereby predisposing to pump failure. So both myocardial ischemia and valvular disorders need to be diagnosed preoperatively. Occult valvular disorders may suddenly become manifest with exposure to surgical stress. Therefore in asymptomatic young patients it would be a safe practice to carry out ECG stress testing prior to surgery.

Conditions apart from these factors which can cause sudden hypotension are carcinoid syndrome and Addison's disease. Preoperative diagnosis of these conditions will help the anesthetist to regularize hemodynamic homeostasis of patients prior to surgical intervention. The surgeon also needs to exercise caution with respect to technique in order to prevent bleeding in such patients. Securing a wide bore venous access, minimizing preoperative dehydration and insertion of invasive blood pressure monitoring can significantly help

in not only reducing an episode of sudden hypotension but early diagnosis of such event.

#### Hypovolemia:

This happens to be a common accompaniment of emergency surgical procedures. Hypovolemia may be present preoperatively as seen in cases of intestinal obstruction. The associated dehydration accompanied with shock gets magnified in to severe episode of life threatening hypotension intraoperatively. It is therefore necessary to ensure optimum correction of dehydration, electrolyte and metabolic disequilibrium prior to surgery. The only exception to this rule is in polytrauma patients wherein the degree of resuscitation is carried out on the basis of anticipated blood loss which may not be accurate in all cases. Assessment of skin turgor, capillary refill, mucous membrane and urine output are the mainstay of clinical evaluation of such patients.

#### Type of Anesthesia:

Assuming that an optimum hemodynamic homeostasis has been achieved preoperatively, anesthetic technique plays a major role as an etiological factor in cases of sudden intraoperative hypotension. Regional anesthesia which happens to be most preferred technique in most centers has most propensity to cause hypotension. Spinal and epidural induced sudden vasodilatation due to sympathetic blockade increases vascular space and thereby predisposing to sudden hypotension. This event usually takes place in the early few minutes following regional anesthesia. The level

of anesthesia is also an important factor determining the blood pressure. If the block ascends above the level of T4 it may result in sudden hypotension, decrease myocardial contractility and bradycardia. Therefore the attending anesthetist needs to be alert throughout the course of the surgical procedure in monitoring the blood pressure.

General Anesthesia which is supposed to be the most controlled technique, may also lead to intraoperative hypotension. This is caused by virtue of effect of intravenous inducing agents and various inhalational gases. The rate and volume of these during the course of administration needs to be closely monitored. Majority of these reduce cardiac output concomitant with systemic vascular resistance. It is therefore a safe practice to have an experienced anesthetist monitor the induction process in general anesthesia.

Pregnancy itself is great physiological stress to woman's body. Therefore pregnant patients undergoing surgery are always prone to develop severe hypotension. A gravid uterus usually compresses the aortocaval blood vessels, thereby reducing venous return predisposing to hypotension. A mild left lateral tilt to displace gravid uterus off the major vessels will help prevent sudden hypotension.

#### Diagnosis

The most common clinical features of intraoperative hypotension could either be severe bradycardia, severe tachyarrhythmia or even cardiac arrest.<sup>[3]</sup> In cases of pulmonary embolism

there may be increase in CVP, cyanosis and bronchospasm. Warm peripheries in the setting of hypotension connotes severe hypotension which may be seen either due to anesthetic drugs or sepsis. Bradycardia prior to hypotension can also be due to airway obstruction. When confronted with such a situation, the surgical team should temporarily suspend the surgical procedure, cover the surgical area with a sterile towel and offer a helping hand to the anesthesiologist. Combined concerted team efforts can work wonders in such a situation. Whilst the team is carrying out rapid resuscitation, the senior most anesthetist should take three important factors into consideration, the risk associated with specific anesthetic technique, the risk specific to the type of surgery and surgical approach and the possibility of idiosyncratic reactions. If analysis of these factors reveals any result, then corrective measures can be instituted rapidly.

A few general measures may be effective in treating an intraoperative hypotensive episode.<sup>[4]</sup>

Call for more help especially of an experienced anesthetist and intensivists.

Inform the surgical team to withhold the operation and seek their input pertaining to blood loss.

Administer 100% oxygen and ensure effective ventilation of lungs

Reduce the dose of volatile agents.

Make a rapid assessment of airway, breathing and circulation followed by measures aimed at improving cardiac output and systemic vascular resistance.

Optimization of preload by administering large boluses of IV fluid which can help significantly. Elevation of the leg end and head down position which improves venous return to heart.

These measures can reverse hypotension especially during regional anesthesia and improve contractility of heart. Further management is continuous administration of fluid boluses, blood products, inotropic support and invasive hemodynamic monitoring of intra arterial pressure. The patient should be housed or shifted to ICU as soon as the hypotensive episode is corrected and incision closed. The reason behind monitoring of such patients after accidents is that they have high propensity to develop complications in various organ systems such as kidney heart, brain and lungs.

### Conclusion

#### Sudden

Sudden intraoperative hypotension continues to be nightmare to the surgeon and a challenge to the anesthetist.

Rigorous pre-operative assessment can detect latent diseases predisposing to intraoperative hypotension.

Continuous close monitoring of such patients by the anesthetist can help in early detection of hypotension.

Aggressive team work for resuscitation and monitoring such patients subsequently can only prevent morbidity and mortality in such a situation.

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