Intraoperative Arterial Hypertension in Noncardiac Surgery: Controversies and Current Recommendations

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Abstract
Arterial hypertension on the day of surgery is a frequently encountered phenomenon nowadays. In many patients, correction of the elevated blood pressure (BP) helps to avoid serious complications and improves perioperative safety. However, there is no general agreement on whether all patients presenting with high BP will benefit from an antihypertensive therapy prior to the start of anesthesia and throughout surgery. In addition, there is no consensus on what should be considered a baseline “normal” value for BP in patients undergoing surgery. This report focuses on controversies in management of intraoperative hypertension and emphasizes the importance of preventing labile BP changes rather than attempting to keep BP within a predetermined target range.

Keywords — Arterial Blood Pressure, Patient Safety, Perioperative Arterial Hypertension, Perioperative Risks.

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INTRODUCTION
Arterial hypertension is among the most widespread chronic conditions in the United States, affecting approximately 30% of people over the age of 20.1,2 Around 30% of these people are unaware of their existing problem and about 40% of individuals with known hypertension fail to seek treatment.3 According to estimates of the World Health Organization, by the year 2025, one third of the global population will be suffering from this illness.1

For a modern-day well-equipped anesthesia team uncontrolled hypertension should not be the sole reason for cancellation of surgery. However, controversies still remain in the management strategy of patients with intraoperative BP elevations.4–7 There are numerous publications discussing various aspects of arterial hypertension and their impact on surgical outcome.4–7 Undoubtedly, severe and uncontrolled perioperative fluctuations of BP pose a major threat and may worsen the surgical outcome, particularly, in patients with cardiovascular disease, cerebrovascular pathology and impaired kidney function.8–10 The major risks associated with intraoperative BP surges include intracranial hemorrhage and myocardial infarction, with mortality rate reaching up to 50%.11 While it has been established that even a brief mean arterial pressure (MAP) decrease (< 55 mm Hg) is associated with the risk of acute kidney and myocardial injury10, the duration of this decrease > 30% from baseline is proportional to the incidence of postoperative stroke.12 There is still a significant knowledge gap regarding potential risks and management strategy in cases of intraoperative hypertension in noncardiac and nonvascular patients. Current recommendations for intraoperative BP management in this patient population remain controversial, and the optimal approach to this problem still has to be determined.

Some of the important questions requiring clarification are:
- Which is the target for intraoperative BP in patients undergoing noncardiac surgery?
- Which measurements correlate better with clinical outcome – systolic, diastolic or mean arterial BP?
- What are the risks associated with tight BP control during surgery?11
- Should the treatment strategy for intraoperative BP control be individualized or a standardized universal approach will be advantageous?

In this article, controversies surrounding the management of intraoperative hypertension are discussed and current recommendations are made.

A principal question is to define the intraoperative BP values that can be considered optimal for an individual patient.
Currently, arterial hypertension in an outpatient setting is defined based on the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High BP (JNC 7). However, these recommendations may not be fully applicable to the perioperative period, as perioperative hypertension differs in pathogenesis, treatment responsiveness and therapeutic approaches.

Important factors influencing the treatment strategy for intraoperative arterial hypertension include but are not limited to patient characteristics, type of surgical procedure, patient positioning on the operating table, anesthetic technique, etc. The complex interplay of these and many other factors makes the standardized management of BP problematic. Evidently, the optimal target BP for an individual patient will depend upon demographic factors, co-morbidities as well as the specifics of surgical procedure. Currently, no strict recommendations are available for perioperative BP target values. Previous outcome studies have suggested that diastolic BP of ≥110 mmHg is detrimental. However, according to recent reports, systolic BP of ≥180 mmHg or mean BP of greater than 20% from baseline may also have a negative impact on clinical outcome.

Careful evaluation of the patient prior to surgery to identify the underlying cause of arterial hypertension is important in selecting the best treatment option. However, the BP measurements performed before surgery may not reflect the patients’ actual hemodynamic status.

Drummond and colleagues have shown that in patients undergoing non-acute ambulatory surgery and presenting with “white-coat” arterial hypertension during the initial assessment in the operating room (P_sys ≥ 160 or P_dia ≥ 100 mm Hg) the measured BP values exceeded the mean BP observed during the preceding 7 months. According to their recommendations, BP values in hypertensive patients acquired before the day of surgery should serve as a reference for baseline BP readings. Thus, using BP values on the day of surgery as a reference may lead to under-treatment of hypertension.

Another question requiring clarification is defining which BP parameters (systolic, diastolic or mean BP) will have a closer association with treatment outcome.

The age-related physiological and vascular structural changes should be considered when determining the optimum strategy for BP management during surgery. Characteristically, diastolic hypertension, either alone or in combination with systolic BP elevation, constitutes the majority of the disease in younger patient population before the age of 50. In contrast, in older patients (> 50 years), systolic hypertension represents the most common form of hypertension. The trend of rise in systolic BP continues throughout life, whereas diastolic BP, which increases until the age of 50, tends to stabilize over the next decade and may even fall later in life. Therefore, diastolic BP is a better predictor of cardiovascular complications than systolic BP until the age of 50. Thereafter, the systolic BP plays a greater role in determining outcome.

Overall, it is practical and appropriate to use the MAP values as a guide in treating hypertension for most patients in the clinical setting.

It is also important to take into account the possible variability of BP values depending on the measurement site and techniques used, as well as the extent of measurement system damping in case of invasive BP monitoring. Once a target BP for a specific patient has been determined, it is necessary to obtain accurate measurements regularly to monitor the dynamic pressure changes over time and eliminate the possibility of random error. Both, the BP measurement site and the mode used (non-invasive versus intra-arterial) influence the pressure values obtained. Non-invasive BP can be reliably measured at multiple sites, including the arm, forearm, wrist and calf. This may be helpful in special surgical circumstances related to patient positioning, and the site of surgery or, in case of obese patients in whom normal cuffs may not be appropriate for their arms, but could be applied on their forearm or calf.

Although the accuracy of non-invasive BP assessment is high over a wide range of pressure measurements, its accuracy decreases at extremes of BP. In trauma patients presenting with systolic BP readings < 110 mmHg, automated measurements have been found to yield consistently higher values compared to auscultatory measurements.

The BP readings obtained during invasive monitoring depend on the site of arterial cannulation, where higher values are recorded from the peripheral arteries. The systolic BP readings in the radial artery can be 10 - 35 mmHg higher compared to measurements obtained from the aorta, a phenomenon that is explained by differences in flow mechanics in vessels of various diameters. Diastolic and mean arterial pressure readings obtained from the subclavian artery (an approximation of proximal aortic pressure) and radial artery correlate better than systolic BP readings. Taking into consideration the variability resulting from BP measurement at different sites and techniques will help the anesthesia provider to determine the optimal BP target range and avoid bias.

Other factors that must be taken into account during intraoperative BP optimization include patient positioning on the operative table and specifics of surgery.

Patients in the sitting or beach chair position should be maintained at a higher BP values than when supine. BP measured in the calf of a patient undergoing shoulder surgery in the beach chair position may vary 50 mmHg or more compared to that measured in the brachial artery. Importantly, the target BP should take into consideration cerebral perfusion pressure. In patients undergoing surgery in the beach chair or sitting position it is recommended to place the pressure transducer at the level of the external auditory meatus to assess the arterial pressure of the circle of Willis. Upright position during surgery may be associated with significant hemodynamic changes that have the potential of compromising the cerebral circulation.

However, with adequate hydration and proper anesthesia management, sitting position is usually well tolerated and associated with remarkable hemodynamic stability.

Hypertension has a significant impact on the autoregulation of blood flow in many vascular beds including the cerebral circulation. The safety limits of cerebral BP variation depend on neurovascular control, surgical pathology and method of anesthesia. Shifts in autoregulatory function
may adversely affect cerebral perfusion even with BP values remaining within the commonly accepted “normal” range.

Certain surgical maneuvers, including intra-abdominal carbon dioxide insufflation during laparoscopic surgery or use of a tourniquet may cause transient hypertension. Treatment of such “temporary” BP surges should be performed taking into account the triggering mechanisms, duration of the procedure, and possibility of adverse reactions. Opioid administration in an attempt to control the increase in BP is not justified in these situations as it may lead to patient overdose, postoperative hypotension and labile BP. It will be more appropriate to prevent significant fluctuations of BP in such patients instead of attempting to keep the BP values at a pre-determined baseline level, thus increasing the risk of ischemic organ damage and adverse drug reactions.

SUMMARY

The optimal management of perioperative hypertension still needs further clarification. Although, adequate control of perioperative BP is justified for patients with significant comorbidities and risks, there is no sufficient evidence to support this approach in all patients presenting with hypertension. Preferably, the approach to BP control should be individualized based on patient demographics, nature of coexisting pathologies and specifics of surgical procedure. BP values obtained before the day of surgery should serve as a reference during surgery.

Overzealous attempts to treat hypertension before anesthesia induction and during surgery may lead to unintentional hypotension, labile BP readings, and increase the need for pharmacological intervention creating a vicious circle. These interventions may lead to unstable anesthesia and increase the risk of perioperative adverse events. The primary aim of BP management during anesthesia should be the prevention of hemodynamic instability rather than attempting to “normalize” a single parameter, namely, the arbitrary predetermined BP value.

Until better evidence becomes available, it may be acceptable to maintain the perioperative mean BP within 20% of baseline, unless, there are specific surgical contraindications for that.

A more aggressive approach may be indicated in patients with high risk of postoperative bleeding or those with severe heart failure. Pre-operative control of blood pressure may be wise if there is evidence of end-organ damage. Preferentially, future recommendations for intraoperative BP management should be based on evidence-based reports, which will also take into account patient-specific as well as procedure-specific factors. Despite better understanding of the mechanisms underlying the perioperative arterial hypertension and advances in anesthesia technique, the problem still requires further research.

REFERENCES


