Preoperative Evaluation of the Patient With Hypertension

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HYPERTENSION, ONE OF THE MOST common chronic diseases in the US adult population, has prevalence in excess of 50% of individuals older than 65 years.1 Approximately 23 million US patients are anesthetized annually; they commonly present for preoperative evaluation to the primary care physician, consultant, surgeon, or anesthesiologist with either diagnosed or undiagnosed hypertension. Even if a patient carries the diagnosis of hypertension and takes antihypertensive therapy, the hypertension may be poorly controlled. Additionally, long-standing hypertension may result in end-organ damage in the heart, brain, and kidneys, which might be unrecognized until the time of the preoperative evaluation. Accordingly, the preoperative evaluation is a unique opportunity to identify patients with hypertension and evaluate them for appropriateness of therapy and the presence of end-organ damage. Given the current pressures to proceed expeditiously with scheduled surgery, it is important for the physicians evaluating such patients to understand the evidence regarding the value of delaying surgery and instituting additional pharmacologic therapies to reduce perioperative and long-term adverse outcomes.

Outcomes of Interest

A wide range of outcomes in patients with hypertension have been studied. While hypertension can affect the brain and kidneys, the vast majority of the perioperative literature has focused on the cardiovascular system. For most cardiovascular interventions, the primary end points studied have been myocardial infarction (MI) and death. However, many of these trials were underpowered to detect these outcomes. Investigators have evaluated the relationship between hypertension and surrogate outcomes such as blood pressure (BP) lability and electrocardiographic changes indicative of ischemia as the primary outcomes of interest. The rationale for inclusion of these outcomes is that they are on the continuum to the development of perioperative cardiac morbidity. Several studies have demonstrated a significant relationship between the occurrence of perioperative myocardial ischemia and fatal and nonfatal MI, with the occurrence of prolonged ischemia identifying those patients at greatest risk.2-5 The vast majority of patients who demonstrate perioperative myocardial ischemia will have an uncomplicated perioperative course, suggesting that suppression of myocardial ischemia alone does not necessarily correlate with a reduced incidence of MI or death.5 Some investigations have used hemodynamic parameters; however, hypotension or BP lability has not been shown to be a significant predictor of myocardial ischemia or infarction.5,6 The strongest available evidence correlates the effect of interventions on the rate of perioperative MIs and death, and not surrogate outcomes.

Perioperative Cardiovascular Complications

Mild to moderate hypertension (stage 1 or stage 2 hypertension) affects patients with systolic BP below 180 mm Hg and diastolic BP below 110 mm Hg. The evidence suggests that these patients do not appear to be at increased operative risk for cardiovascular adverse outcomes. In 1979, Goldman and Caldera7 studied 196 patients with hypertension (79 adequately treated, 40 inadequately treated, and 77 untreated) and observed no difference in perioperative outcome. Several large-scale trials of consecutive adult patients undergoing noncardiac surgery were not able to identify hypertension as a predictor of cardiovascular complications.8,9

There are several issues in interpreting these results. These studies acknowledge the absence of patients with diastolic BPs of more than 110 mm Hg, limiting the generalizability of their findings to the population with poorly controlled hypertension. The diagnosis of hypertension may have triggered an evaluation for occult coronary artery disease, whose presence would then negate the original impact of hypertension alone in these multivariate models. For example, the presence of new Q waves on an electrocardiogram would have triggered further diagnostic testing. It is therefore important as part of the preoperative evaluation to distinguish whether the patient has isolated hypertension or also has coexisting coronary artery disease. For those with isolated mild to moderate hypertension, the current recommendation is that it is appropriate to proceed to surgery without delay or escalation in medical therapy.10

For patients with severe hypertension (stage 3, systolic BP >180 mm Hg and diastolic BP >110 mm Hg), many physicians and investigators believe that BP should be controlled prior to proceeding to elective noncardiac sur-

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PREOPERATIVE EVALUATION OF HYPERTENSION

Box. Hypertensive Comorbidities Associated With Adverse Perioperative Outcomes

- Occult coronary artery disease (Q waves on the electrocardiogram)
- Congestive heart failure
- Left ventricular hypertrophy (voltage criteria)
- Renal insufficiency (serum creatinine level >2.0 mg/dL [>176.8 µmol/L])
- Cerebrovascular disease (history of cerebrovascular accident or transient ischemic attack)

In the absence of overt coronary artery disease, the presence of left ventricular hypertrophy defines the subset of ambulatory patients with an increased risk of cardiovascular complications. In a study of patients undergoing major vascular surgery, voltage criteria for left ventricular hypertrophy and ST-segment depression of more than 0.5 mm on preoperative electrocardiograms were both significantly associated with postoperative MI or cardiac death (odds ratio, 4.2 and 4.7; P = .001 and P < .001, respectively). Hollenberg et al studied a consecutive sample of 474 men at high risk for or with coronary artery disease who were scheduled to undergo major noncardiac surgery and demonstrated that hypertension and left ventricular hypertrophy were associated with an increased incidence of perioperative myocardial ischemia. Myocardial ischemia can result in patients with ventricular hypertrophy from supply and demand mismatches even in the absence of coronary artery stenoses; this supports better control of hypertension in these patients.

Chronic renal insufficiency is a common sequela of hypertension. Patients with hypertension should have a measurement of baseline serum creatinine. In the original Cardiac Risk Index, an elevated serum creatinine level (>3.0 mg/dL [>265.2 µmol/L]) was one of the independent risk factors for perioperative cardiovascular morbidity and mortality. This has been confirmed in the revised Cardiac Risk Index, in which a preoperative serum creatinine level greater than 2.0 mg/dL (>176.8 µmol/L) was 1 of 6 independent factors that predicted increased cardiovascular risk.

Hypertension is also a risk factor for cerebrovascular disease. Several studies have demonstrated the association between a preoperative history of a cerebrovascular accident and the occurrence of perioperative cardiac events. While acute hypertensive crises can lead to a stroke from an intracerebral bleed, abrupt decreases in BP can lead to injury from cerebral ischemia. It is therefore prudent to establish norm levels for surgery, however, these recommendations have been based upon studies with small sample sizes with outcomes other than fatal or nonfatal MIs. In Gold- man and Caldera’s study of 196 patients with hypertension, there were only 5 patients with a diastolic BP of more than 111 mm Hg. Although this group of patients had an increased incidence of hypertensive episodes, there was no increase in perioperative MI or death. In contrast, Prys-Roberts et al performed a series of studies in the 1970s on small groups of patients with hypertension and documented increased hemodynamic lability, arrhythmias, and myocardial ischemia in patients whose preoperative diastolic BP was more than 110 mm Hg.

In the face of conflicting evidence, the sixth report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-VI) recommends delay of surgery when the preoperative diastolic BP exceeds 110 mm Hg. In such patients, BP should be reduced slowly for fear of increasing morbidity and mortality secondary to a critical coronary or carotid arterial stenosis. The period of time required to adequately correct the hypertension is unknown, though amelioration of some of the myocardial and vascular changes related to severe hypertension may require a minimum of 6 to 8 weeks of therapy to reverse. The decision to delay surgery for long-term stabilization of BP, vs acutely correcting the hypertension, must take into account the potential benefits and the urgency of the surgical procedure.
Maintenance of BP in a patient with hypertension and document that lowering BP in a patient with poorly controlled hypertension does not result in neurologic changes.

**Should Preoperative Cardiac Testing Be Performed?**

The American College of Cardiology and American Heart Association have recently updated their Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery. The Guidelines advocate integration of clinical risk factors, the patient's exercise capacity, and surgical risk in the decision to perform further diagnostic testing. Based upon the information described, hypertension is considered a minor risk factor. Isolated hypertension should trigger a discussion of the value of preoperative cardiac testing only in patients undergoing high-risk procedures such as major vascular surgery.

Based upon the high incidence of end-organ damage, patients with hypertension should have a preoperative electrocardiogram and measurement of serum creatinine level. If the electrocardiogram demonstrates Q waves indicative of a silent MI or the preoperative serum creatinine level is greater than 2.0 g/dL (>176.8 μmol/L), then this constellation of risk factors would place the patient at moderate clinical risk. If this patient also has a poor exercise tolerance and is undergoing high- or intermediate-risk (eg, abdominal or thoracic) surgery, then preoperative testing should also be considered, but only be performed if the results will impact on the patient's care. Testing is indicated if the results might lead to coronary revascularization, changes in perioperative monitoring, or medical management.

**Treatment of Hypertension**

As a general rule, antihypertensive medications should be continued until the day of surgery. The hazards of withdrawal of antihypertensive medications have been known since the 1970s. Abrupt discontinuation of β-blockers has been associated with perioperative tachycardia. Withdrawal of clonidine has been associated with rebound hypertension.

One class of agents may present problems during the perioperative period. Continuation of angiotensin-converting enzyme inhibitors through the morning of surgery has been associated with hypotension requiring vasopressor therapy after induction of general anesthesia. Bertrand et al performed a randomized controlled trial of continuation or discontinuation of angiotensin II inhibitors in patients chronically treated with these agents and reported more frequent and severe hypotension in the group who continued the drugs. Those authors suggest that angiotensin II inhibitors should be held the morning of surgery and parenteral antihypertensive agents may be given intraoperatively, if needed.

Garlic, often used by patients who wish to decrease their BP without taking prescription medications, has anticoagulant properties that need consideration in the face of surgical procedures. Patients should be queried about any over-the-counter products they ingest and given appropriate advice on their discontinuation before procedures.

With regard to the optimal treatment of the patient with poorly or uncontrolled hypertension during the preoperative evaluation, recent Guidelines and the JNC-VI suggest that the best treatment may be cardioselective β-blocker therapy. An expanding body of evidence suggests that perioperative β-adrenergic blockade administration improves cardiac outcomes following noncardiac surgery. An unblinded study of a single small dose of β-adrenergic blocking agents in untreated patients with hypertension found significantly fewer episodes of myocardial ischemia in the patients treated with β-adrenergic blocking agents vs controls. The strongest evidence for β-blocker therapy comes from high-risk cardiac patients; there is limited information about patients with hypertension who do not have known coexisting disease. In a randomized controlled trial of patients undergoing major noncardiac surgery, atenolol was administered intravenously or orally the morning of surgery, continued for 7 days postoperatively, and was associated with a significantly lower incidence of perioperative ischemia compared with placebo. No difference in perioperative MI or cardiac death was noted in this study of 200 patients but a significantly improved 6-month event-free survival was found following atenolol administration. More recently, Poldermans et al studied the perioperative use of bisoprolol in elective major vascular surgery. Patients received their medication for at least 7 days preoperatively, titrated to achieve a resting heart rate of less than 60/min, and continued postoperatively for 30 days. Among patients with at least one clinical risk factor and a positive dobutamine echocardiogram, bisoprolol led to an approximate 80% decrease in perioperative MI or cardiac death in this high-risk population.

Intraoperative and postoperative treatment of hypertension can be achieved with multiple agents. Since several days may lapse before oral intake is resumed, parenteral treatment with diuretics, adrenergic inhibitors, vasodilators, angiotensin-converting enzyme inhibitors, or use of transdermal clonidine have all been proposed in the JNC-VI. It is critical to initiate some form of therapy to prevent rebound hypertension and tachycardia observed from withdrawal of these agents.

**Conclusion**

The strength of evidence suggests that the patient with stage 1 or 2 hypertension and no evidence of end-organ damage or coexisting cardiovascular disease may safely proceed to surgery without escalation of therapy. For those patients with stage 3 hypertension (diastolic pressure >110 mm Hg), there is insufficient evidence to determine the approach leading to the best outcome, though some authors have suggested that postponement of elective surgery for 6 to 8 weeks of antihypertensive therapy may allow regression of some of the vascular changes associated with hyperten-
vascular surgery, β-adrenergic blocking agents may be effective in reducing cardiovascular complications. If sufficient time exists (minimum 7 days), titration of β-blocking agents to a resting heart rate of 60/min should be the goal. For more acute preoperative administration (<7 days), additional β-blocker medications can be given preoperatively and intraoperatively and incorporated into the anesthetic plan.

In many patients, hypertension is associated with coronary artery disease, left ventricular hypertrophy, chronic renal insufficiency, and cerebrovascular disease, which may not have been identified prior to the preoperative evaluation. For these patients, additional interventions, including cardiovascular testing, should be contemplated to reduce perioperative risk of adverse outcomes. By using the preoperative evaluation as an opportunity to evaluate and intervene in patients with hypertension, perioperative and long-term outcomes may be improved.

REFERENCES


