



Research Paper

Hypertension and Laproscopic Surgery

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ABSTRACT

Hypertension is a coincidental finding which has come across majorly to anaesthesiologist in pac or ot in routine surgeries. So the dilemma remains whether to go ahead with the surgery or postpone the surgery to optimise the BP. The importance of hypertension is increased in surgeries like laproscopic surgeries where there are cardiovascular effects because of nature of surgery also lead to increase in blood pressure.

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I. INTRODUCTIONS

Hypertension, also known as high blood pressure (BP), affects millions of people. According to JNC 8, hypertension is defined as Persistent (average of 2 or more readings 2 minutes apart on 2 or more occasions 1-4 weeks apart) systolic blood pressure (SBP) >140 mmHg and/or diastolic blood pressure (DBP) >90 mmHg in adults¹. In India, the prevalence of hypertension is 28%–32% in the urban population and 27.6% in the rural population². Hypertension is known as the “silent killer” because it typically has no warning signs or symptoms, and many people do not know they have it³. So anaesthesiologists have very high probability of encountering undiagnosed hypertensives as well as uncontrolled hypertensives at the time of routine preoperative assessment. Primary Hypertension is when there is no precipitating cause. Secondary Hypertension is when there is a precipitating cause like pregnancy-induced hypertension, coarctation of aorta, renal artery stenosis or pheochromocytoma.

CLASSIFICATION OF HYPERTENSION

| Systolic and Diastolic BP (mm Hg) | JNC7 | 2017 ACC/AHA |
|-----------------------------------|----------------------|----------------------|
| <120 and <80 | Normal BP | Normal BP |
| 120-129 and <80 | Prehypertension | Elevated BP |
| 130-139 or 80-89 | Prehypertension | Stage 1 hypertension |
| 140-159 or 90-99 | Stage 1 hypertension | Stage 2 hypertension |
| ≥160 or ≥100 | Stage 2 hypertension | Stage 2 hypertension |

Various stages/grades of blood pressure have been defined in several guidelines for risk stratification and management (table 1). The 8th report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of high blood pressure suggests that antihypertensive treatment should be initiated in older individuals >60 years if the blood pressure is >150/90 mmHg with a goal of reduction to <150/90 mmHg; whereas in younger individuals aged 18–59 years, antihypertensive treatment should be initiated if the blood pressure is >140/90 mmHg with a goal to reduce the pressure below this level⁴

Uncontrolled hypertension is defined as an average systolic blood pressure ≥140 mmHg or an average diastolic blood pressure ≥90 mmHg, among those with previously diagnosed hypertension. HYPERTENSIVE CRISIS is BP >180/120 categorized as hypertensive urgency and hypertensive emergency. HYPERTENSIVE URGENCY is BP >180/120 without end organ damage but imminent threat for damage. HYPERTENSIVE EMERGENCY is BP >180/120 with evidence of end organ damage. ACUTE HYPERTENSIVE EPISODE is BP >180/110 without end organ damage with no imminent threat for damage present. WHITE COAT HYPERTENSION/SUSTAINED HYPERTENSION is BP >140/90 in office and less than 135/85 at home. White coat hypertension (elevation of clinic BP only) confers significantly less risk of death than sustained hypertension (elevation of both clinic and ambulatory BPs).

Resistant hypertension is defined as blood pressure that remains above goal in spite of the concurrent use of 3 antihypertensive agents of different classes and one of these 3 being a diuretic and all agents should be prescribed at optimal dose amounts OR Hypertension controlled by 4 or more medications.

CAUSES OF RESISTANT HYPERTENSION

Pseudo-resistance - Poor Blood Pressure Monitoring Technique

Poor Adherence to drug schedule

White-Coat Effect

Lifestyle Factors - Obesity, Higher dietary Salt intake, Alcohol

Drugs - Non-narcotic analgesics, NSAIDS including ASPIRIN

Sympatho-mimetic agents (decongestants, diet pills, cocaine)

Stimulants (amphetamine, methamphetamine, modafinil)

Oral contraceptives, steroids

Cyclosporine, Erythropoietin, Herbal compounds (ephedra)

II. IMPACT OF UNCONTROLLED HYPERTENSION ON ORGAN SYSTEM:

CARDIOVASCULAR SYSTEM

Uncontrolled hypertension leads to loss of arterial elasticity and compliance of both smaller arterioles and larger conduit arteries⁵. There is arterial stiffening leading to widening of the pulse pressure i.e. increased difference between the SBP and DBP, due to systolic pressure summation and loss of diastolic augmentation. Uncontrolled hypertension leads to compensatory hypertrophy of the myocardium to minimize the wall stress (Laplace's law) and decreased coronary perfusion leading to Myocardial ischemia and/or infarction^{5,6}. Hypertension is associated with diabetes, dyslipidemia and obesity which are known risk factors for the development of coronary artery disease⁶.

CEREBROVASCULAR SYSTEM

Hypertension is a risk factor for ischemic and hemorrhagic brain injury⁷. In addition, because the auto-regulation shifts to the right in hypertensives, any degree of hypotension would reduce the cerebral blood flow leading to worsening of cerebral ischemia. A history of stroke to be a predictor of adverse perioperative cardiovascular events⁸.

RENAL SYSTEM

Chronic renal insufficiency is sequelae to hypertension. In the Revised cardiac risk index, a pre-operative serum creatinine >2.0 mg/dl is identified as an independent factor that predicts increased cardiovascular risk⁹.

ENDOCRINE SYSTEM

Diabetes mellitus and hypertension frequently coexist in middle aged and geriatric group of population and increase the risk of perioperative cardiovascular events

OPHTHALMIC SYSTEM

Chronic hypertension can lead to changes in retinal microcirculation leading to hypertensive retinopathy which is characterized by blurred vision, headache, frequent change of glasses and if not treated in time may lead to loss of vision.¹⁰

TREATMENT OF HYPERTENSION

LIFE STYLE MODIFICATION

Healthy lifestyle choices can prevent or delay the onset of high BP and can reduce cardiovascular risk.¹¹ Lifestyle modification is also the first line of antihypertensive treatment. Modifications in lifestyle can also enhance the effects of antihypertensive treatment. Lifestyle modifications should include reduction in salt intake, regular exercise, reduction in caffeine and smoking, weight loss.

PHARMACOLOGICAL TREATMENT

The mainstay of treatment is antihypertensive drugs. The main class of drugs include: Angiotensin-converting enzyme (ACE) inhibitors, Angiotensin receptor blockers (ARBs), Calcium channel blockers (CCBs), Diuretics, β -blockers. The aim is reducing blood pressure and to induce remodeling of the left ventricle, such as regression of left ventricular hypertrophy, and confer long-term survival benefits. (table 1)

Patients <55 years are started on **ACE inhibitors** or a low-cost **ARB** (if ACE inhibitor is not tolerated or contraindicated)¹². The much-feared risks of intraoperative hypotension may be more prevalent in patients

with heart failure and those receiving combination therapies with other antihypertensives current literature suggests continuing ACE inhibitors even perioperatively, especially if started for hypertension¹³

Patients >55 years started on **calcium channel blockers (CCB)** or a **thiazidediuretic** if CCBs are not tolerated (e.g. edema, heart failure or at risk for heart failure). CCBs can be safely continued up to the morning of surgery without significant risk of hypotension. Caution in patients who have heart failure or are hypovolemic¹².

Diuretics are continued into the perioperative period, especially in patients who are diuretic dependent (e.g. heart failure) but patients are at risk of having hypokalemia. Beta blockers not preferred initial therapy for hypertension and mainly reserved for younger patients in whom there is intolerance or contraindication to ACE inhibitors or ARBs in women of child-bearing potential, patients with evidence of increased sympathetic drive.¹²

PREOPERATIVE EVALUATION IN HYPERTENSIVE PATIENT.

Hypertension **mostly silent and first detected in the PAC**. If PAC occurs a few days before planned surgery, the primary detection of raised blood pressure (>140/90 mmHg) ,measure BP three times after sufficient rest. If BP reading still >140/90 ,refer patient to general physician to differentiate between white coat and sustained hypertension .General physician should refer hypertensive patients for elective surgery after the blood pressure is better controlled and type of hypertension is understood by history, examination and investigations.

In patients with blood pressures of >180/110 mmHg or those with evidence of organ damage, look at other factors such as associated co-morbidities, functional class of the patient and urgency of the surgery¹⁴. The higher allowable blood pressure measured in PAC is because many patients can develop '**white coat**' **hypertension in stressful surroundings**. BP control reduces target organ damage over a long period (years). No evidence that acute peri-operative reduction of blood pressure confers any advantage in reduction of adverse cardiovascular events beyond 1 month in primary care¹⁵

Along with the routine investigation of complete blood count ,kidney function test, liver function test, blood sugar for PAC patient may show sign of ischemia, left ventricular hypertrophy or abnormal electrical activity on ecg.ECHO is not indicated in all the patients.

Only in major surgeries like vascular and transplant surgeries or in which we suspect any ischemic heart disease or structural heart disease or any signs and symptoms of heart failure.

Any other investigation may be indicated if we are suspecting any secondary cause of hypertension.(table)

Drug history of the type, dosing and compliance of antihypertensives important.along with any other drug intake for any other disease.All the hypertensives to be continued till the morning of surgery except for ACE inhibitors and ARB which can cause refractory hypotension if continued in surgeries where large fluid shifts are expected in which case should be discontinued 24 hours before surgery.

PERIOPERATIVE MANAGEMENT OF HYPERTENSIVE PATIENTS

The American College of Cardiology and the American Heart Association list "uncontrolled systemic hypertension" as a minor predictor that has not been shown to independently increase perioperative risk.Hemodynamic swings are more common and exaggerated in hypertensive patients as compared to normotensives . There is rightward shift of auto-regulation which means organ perfusion occurs at higher mean arterial pressures as compared to normotensives, and thus, intraoperative hypotension leads to hypoperfusion and target organ damage¹⁶. It is advisable to keep the blood pressure within 20%–30% of baseline values¹⁷.

The choice of anaesthesia depends on surgery and no single anaesthetic technique is superior to another. Sevoflurane has been reported to confer cardio protection and better hemodynamic stability as compared to propofol. It is important to maintain an adequate depth of anesthesia with monitoring such as bispectral index or end-tidal minimum anesthetic concentration that allows appropriate titration of anesthetic agents¹⁵. Similarly, for spinal/ epidural anesthesia, one must avoid precipitous and sudden fall of blood pressure.

For monitoring in hypertensives patients for laproscopic surgeries routine monitoring ECG ,NIBP, Spo2 and ETCO2 are done . Invasive monitoring such as CVP and IBP are done in Surgeries involving significant fluid shifts or requiring inotropic support or high-risk surgery and in hypertensive crisis which requires treatment with vasoactive drugs.

It is well established that laparoscopic procedures, due to CO2 insufflation, bloating, chest compression and the Trendelenburg position, difficults venous return, increase peripheral vascular resistance and mean arterial pressure and stimulate the release of catecholamines. The initiation of pneumoperitoneum triggers an adrenergic response, provoking a significant increase in mean abdominal pressure, increased peripheral and pulmonary vascular resistance¹⁸.

For the anaesthesiologist, the intraoperative management of patients with HTN poses a challenge due to their greater sensitivity during this period. This increased risk of intraoperative HTN is exacerbated in laparoscopic surgeries, during pneumoperitoneum, due to the hypertensive effect of the CO₂ and the release of cortisol and catecholamines, especially noradrenaline.

Hypertensive episodes >20 % from baseline are associated with adverse outcomes¹⁴. and should be urgently treated with the goal of blood pressure reduction. Initially patient should be managed by increasing the depth of anaesthesia and giving additional analgesics; however, if this fails to resolve the hypertensive surges, then drugs that modify the vascular system may be used to reduce the blood pressure [Table 3],[36,38] with the goal being not >20%–25% reduction within the first 30–60 minutes and gradual return to baseline over the next 24–48 hours¹⁵.

III. CONCLUSION

Hypertension is frequently encountered on first time basis in ot and pac. If the patient is in pac when first seen, then patient to be given adequate rest and bp measurement to be adhered to standard technique in order to obtain reproducible measurements representative of patients true pressure. BP upto 180/100 is not itself a reason for deferring elective surgery and in patient who have persistently high bp, decision to be made on case to case basis whether to defer the surgery to start the antihypertensives will benefit the patient. In recent years the focus of management of hypertension has been shifted from deferring surgery for mild to moderate hypertension to proper management and to be maintained reasonably close to baseline in intraoperative period.

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TABLE 2

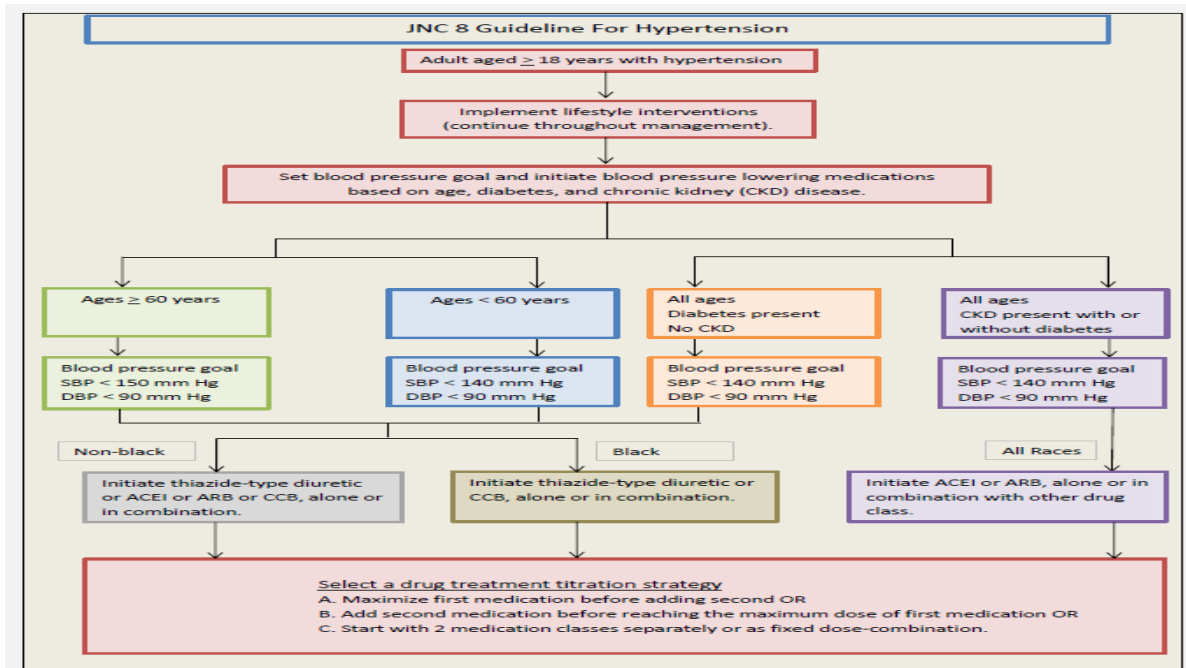


TABLE 3

| Agent | Dosage | Onset | Duration |
|----------------|--|-------------|------------|
| Nitroprusside | 0.5 – 10 ug/kg/min | 30-60sec | 1-5 mins |
| Nitroglycerine | 0.5 – 10 ug/kg/min | 1 min | 3 – 5mins |
| Esmolol | 0.5mg/kg in 1 min 50 – 300 ug/kg/min infusion | 1 min | 12-20 mins |
| Labetolol | 5-20 mg | 1-2mins | 4-8 hrs |
| Propranolol | 1-3 mg | 1-2 mins | 4-6 hrs |
| Phentolamine | 1-5 mg | 1 – 10 mins | 20-40 mins |
| Hydralazine | 5-20 mg | 5-20 mins | 4-8 hrs |
| Nifedipine S/l | 10 mg | 5-10 mins | 4 hrs |
| Nicardipine | 0.25 – 0.5 mg | 1-5 mins | 3-4 hrs |
| Enalapril | 0.625 – 1 mg77 | 6-15 mins | 4-6 hrs |
| Methyl dopa | 250 – 1000 mg | 2-3 hrs | 6-12 hrs |

TABLE 4

| | | |
|----------|--|---|
| 1 | Urgent reduction of severe acute hypertension | Sodium nitroprusside infusion 0.3 – 2 ug/kg/min |
| 2 | HT with ischemia with poor LV | NTG infusion 5 – 100 ug/kg |
| 3 | HT with ischemia with Tachycardia | A. Esmolol bolus or infusion 50 – 250 ug/kg/min |
| 4 | HT with heart failure | Enalapril at 0.5 – 5mg bolus, 1.25 mg/6 hours given over 5 mins. Response within 15 mins |
| 5 | HT without cardiac complications | Nifedipine – 5 – 10 mg S/l Nicardipine infusion – 5 – 15 mg/hr Hydralazine 5 – 10 mg bolus |
| 5 | HT with Pheochromocytoma | Labetolol – Bolus 2 – 10mg Infusion 2.5 – 30 mic g/kg/min Phentolamine 1-4mg bolus |