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Arterial Hypertension, a Frequent Comorbidity in Diabetes: the Perioperative Management

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Abstract

Arterial hypertension and diabetes mellitus frequently coexist. Preexisting arterial hypertension is a main re ason for postponing surgery in diabetic patients. Hypertension is a risk factor for cardiovascular complicat ions during the perioperative period. The term peri-operative generally refers to the three phases of surgery: pre-operative, intra-operative, and post-operative.

Sympathetic activation during the induction of anesthesia can cause increases in blood pressure by 20 to 30 mm Hg and increases in heart rate by 15-20 beats per minute in patients with normal blood pressure values. These values are higher in patients with untreated hypertension. The effect of chronic hypertension on pe rioperative risk is determined primarily by the presence of target organ damage, coronary artery disease , stroke, heart failure and renal failure, all of which are known to affect perioperative morbidity and mortalit y. There are no randomized clinical trial data showing what the optimal blood pressure should be at the ti me of surgery. In patients with grade

1 or 2 hypertension, there is no evidence of benefit from delaying surgery to optimize therapy. In such case s, antihypertensive medications should be continued during the perioperative period.

Most antihypertensive drugs should be continued to the day of surgery and restart as soon as possible (whe n the patient will be able to swallow). Only agents that affect the renin-angiotensin- aldosterone system should be canceled (angiotensin-converting enzyme inhibitors and angiotensin receptor blockers). Regar ding beta-blockers, the treatment should ideally be initiated between 30 days and at least 2 days before surg ery, starting at a low dose, and should be continued post- operatively. The target is a resting heart rate 60-70 bpm and systolic blood pressure > 100 mm Hg.

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1. Introduction

Arterial hypertension is one of the most common cardiovascular diseases worldwide. Diabetic patients ha ve an increased risk of arterial hypertension [1, 2]. Arterial hypertension is the most frequent preoperative a bnormality in surgical patients [3, 4]. Preexisting arterial hypertension is a main reason for postponing surge ry in diabetic patients. Moreover, hypertension is a risk factor for cardiovascular complications during the p erioperative period [5]. The term “perioperative” generally refers to the three phases of surgery: pre-operati ve, intra-operative, and post-operative.

But how important is peri-operative hypertension? The effect of chronic hypertension on perioperative risk is determined primarily by the presence of target organ damage: coronary artery disease, stroke, heart failur e, kidney failure, all of which affecting perioperative morbidity and mortality. Nowadays, it is not very clea r if increased blood pressure values have an independent effect on morbimortality. Target organ damage a ssociated with hypertension and total cardiovascular risk, rather than high blood pressure *per se*, seem to de termine the perioperative risk. The perioperative outcomes depend also on associated hypertensive c omorbidities: coronary artery disease, heart failure, left ventricle hypertrophy, kidney damage (serum creati nine > 2 mg/dL), and cerebrovascular disease [6, 7, 8].

> **From the pathophysiological point of view, there are many chang es in the perioperative period which lead to increases of blood pr essure values. The operative stress induces sympathetic activati on, with increased cardiac output, sodium retention, vasoconstric tion, increased heart rate.**

The regulation of blood pressure depends on heart rate, left ventricle stroke volume and vascular resistance . Discontinuation of antihypertensive medication prior to or immediately after surgery is another reason for blood pressure increases during the perioperative period. The sympathetic activation in the perioperative per iod is even more pronounced in untreated hypertensive patients. Acute hypertension increases the risk of ble eding at the surgical site or intracranial and the risk of myocardial ischemia.

75% of patients in the perioperative period have increased blood pressure for 2-6 hours [9]. The perioperati ve hypertension is common with coronary artery by-pass graft (30-80%) [9]. The incidence of perioperative hypertension is increasing, due to aging population, increased use of cardiovascular procedures, decreased use of opioid anesthesia and postoperative sedation.

2. Problems in the clinical practice

In the clinical practice, there are some controversies regarding the management of hypertensive patients [10, 11]. These controversies are related to antihypertensive drugs interactions with anesthesia, the influenc e of antihypertensive medication on the peri-operative outcome, management of surgical patients with isola ted systolic hypertension or “white ‘coat hypertension”, indications for postponing or even cancellation of surgery in hypertensive patients [12].

Perioperative hypertension occurs during induction of anesthesia, hypothermia, hypoxia, intraoperatively due to pain-induced sympathetic stimulation, intravascular volume overload in the first 24-48 hours postoperatively, as fluid is mobilized from extravascular space. During the induction of anesthesia, sympathetic activation may induce a blood pressure increase by 20-30 mm Hg and the heart rate increase by 15-20 bpm in normotensive individuals; these responses may be more important in patients with untreated hypertension. As anesthesia progresses, hypertensive patients are more likely to present intraoperative blood pressure lability, with an increased risk of myocardial ischemia. After surgery, pain, agitation, hypoxemia, hypervolemia, hypercapnia may induce postoperative hypertension.

When assessing patients with arterial hypertension prior to surgery, there is a number of questions that must be answered: “Is the patient known with arterial hypertension or is a newly diagnosed hypertension? Is the patient under treatment with antihypertensive drugs? Is it a primary or a secondary hypertension? Does the patient have a treatable cause of hypertension? Does the patient have “white-coat hypertension?” Is there a need to modify the drugs doses perioperatively? Should we postpone the operation in order to control the blood pressure? What additional tests are needed? Which is the appropriate pharmacotherapy before, during and after the operation?”

Therefore, in some cases, the referring physician should be contacted in order to obtain a more accurate medical history and blood pressure values than the ones measured during the current hospital admission.

The preoperative evaluation of a hypertensive patient should identify undiagnosed or uncontrolled hypertensives and estimate the true level of the blood pressure values, in order to reduce the operative risk in the short-term period and the adverse long-term effects. Perioperative hypertension usually lasts 2-6 hours and requires rapid intervention, to avoid mortality and unplanned critical care admissions.

For a correct diagnosis, the measurement of the blood pressure should strictly adhere to the recommendations of the guidelines: the patient must sit quietly, he should not be engaged in any conversation, the arm should be at the heart level, an appropriate size cuff should be used. If the blood pressure is found increased, a second measurement should be done, with an interval of at least 1 minute between readings. Postoperatively, the blood pressure must be measured every 5-
15 min during the first hour, then every 30 min until 3 hours postoperative. If the diagnosis of
arterial hypertension is established, the assessment of the organ damage is important, because heart failure, renal impairment, coronary artery disease or cerebrovascular disease may increase the perioperative risk [13].

A blood pressure higher than 180/110 mm Hg defines a hypertensive crisis, the patient being at risk for end-organ damage. The hypertensive urgency is the severe asymptomatic hypertension, whereas hypertensive emergency defines the presence of end-organ damage. The signs and symptoms of end-organ damage in a hypertensive emergency are chest pain, arrhythmias, dyspnea, orthopnea, peripheral edema, headache, vomiting, seizure, hematuria, proteinuria, weakness, numbness, blurred vision, retinal hemorrhage, severe anxiety.

3. Management of perioperative hypertension

Common reasons for delayed surgery in patients with hypertension are: poorly controlled arterial hyperte nsion grade 3 according to the European Society of Cardiology (systolic blood pressure ? 180 mm Hg a nd/or diastolic blood pressure ? 110 mm Hg), identifying end-organ damage that has not been previously be en evaluated or treated, suspicion of secondary hypertension without properly documented etiology [14]. Th ere are no randomized clinical trial data showing what the optimal blood pressure should be at the time of surgery. The 2014 European Society of Cardiology Guidelines on non-cardiac surgery mention that in patie nts with grade 1 or 2 hypertension (systolic blood pressure < 180 mm Hg, diastolic blood pressure < 110 mm Hg), there is no evidence of benefit from delaying surgery to optimize therapy [15]. In such cases, antih ypertensive medications should be continued during the perioperative period [16]. Most antihypertensive dr ugs should be continued to the day of surgery and restart as soon as possible (when the patient will be able to swallow). Only renin-angiotensin system inhibitors should be stopped the morning of surgery [17]. Diure tics should be maintained until surgery (they may be stopped the day of surgery in case of hypovolemia). Regarding angiotensin-converting enzyme inhibitors and angiotensin receptor blockers, the European Societ y of Cardiology Guidelines recommend continuation of these drugs, under close monitoring, during non-ca rdiac surgery in stable patients with heart failure and left ventricle systolic dysfunction [14]. Treatment with beta-blockers should ideally be initiated between 30 days and (at least) 2 days before surgery, starting at a low dose, and should be continued post- operatively [14]. The target is a resting heart rate of 60-70 bpm, and a systolic blood pressure >100 mm Hg [14]. In patients under treatment with beta-blockers, the c ontinuation of treatment is recommended. Preoperative initiation of beta-blockers may be considered in pati ents with coronary heart disease or myocardial ischemia. According to the results of POISE trial, perioperati ve use of beta-blockers may benefit only patients at highest risk and may harm other patients: in patients with Lee index > 3 there is a significant decrease in mortality, with Lee index 1 or 2 there is no significant d ifference and if Lee index is 0 there is an increase in mortality [18].

Preoperative beta-blockers withdrawal leads to an increase in mortality [18].

Among perioperative complications, acute postoperative hypertension is the most frequent one. The ac ute postoperative hypertension manifests in the first 20 minutes of the postoperative period and lasts an ave rage of 3 hours. If it is left untreated, the acute postoperative hypertension is a major risk factor for bleeding s, stroke, myocardial ischemia, arrhythmias, heart failure with pulmonary congestive edema, other vascular complications [19].

Esmolol and labetalol are the beta-blockers of choice for the treatment of acute postoperative hypertension [20]. Esmolol has the onset of action in 1-2 min and the half-life of 9 min. It is indicated in intraoperative a nd postoperative tachycardia and/or hypertension, and in supraventricular tachycardia [20]. It is contraind icated in sinus bradycardia, 2nd or 3rd-degree heart blocks, cardiogenic shock or overt heart failure. Labe talol is a combined non-selective beta- blocker and alpha1-blocker, but the beta-blockade is 7 times highe r than alpha-blockade. It is not associated with decreased cardiac output seen with other beta-blockers. Th e onset of action is in 5-15 min per bolus and the half-life is 5 1/2 hours. Labetalol is indicated to control the blood pressure in severe hypertension [20].

Nitroprusside is a vasodilator for both arteries and veins, with the onset of action less than 1 min and a half-life of 3-4 min. Treatment with nitroprusside requires careful blood pressure monitoring with intra-arterial li ne and frequent dosage adjustments [20]. The initial dose is 0.5 mcg/Kg/minute. Nitroglycerin is a va sodilator with a rapid onset of action and it is useful in patients with heart failure, cardiac ischemia. The init ial dose is 5 mcg/min and the onset of action is between 2-5 minutes [20]. Hydralazine may be used for ac ute postoperative hypertension, 3-20 mg initially, with an onset of action between 5-15 minutes and a durati on of action of 6-12 hours [20]. Enalaprilat is used in an initial dose of 0.625-1.25 mg, with an onset of acti on of 15 minutes and a duration of action of 6 hours; it is indicated when oral therapy is not practical [20]. Fenoldopam is a dopamine D1-receptor agonist with an onset of action < 5 min and a half-life of 5 min [20] . It is indicated for the short-term management of severe arterial hypertension and it has no contraindicati ons, but in some patients may cause allergic reactions. Other antihypertensive agents which may be used for the treatment of acute postoperative hypertension are nicardipine, clevidipine, clonidine, urapidil. Nica rdipine is a very selective dilator, used in doses of 1-5 mg/hour for 12 hours maximum [20].
If the patient has severe hypertension, with values higher than 180/110 mm Hg, the physician should careful ly search for symptoms and signs of end-organ damage: stroke, encephalopathy, myocardial ischemia, hea rt failure, renal or visual impairment. Antihypertensive treatment should be administered immediately, with the goal to decrease the blood pressure with no more than 25% during the first hour, in order to avoid organ perfusion deficits.

4. Conclusions

Perioperative hypertension is frequently encountered in the surgical wards and requires pharmacological tre atment.

> **There are no specific guidelines regarding the management of pe rioperative hypertension. The treatment must be individualized according to the values of the blood pressure, end-organ damage , and associated comorbidities [21-24].**

There are no significant differences in outcomes of surgical patients, normotensive, and those hyperte nsives, with a blood pressure less than 180/110 mm Hg. Patients referred to surgery with blood pressure va lues higher than 180/110 mm Hg should be carefully examined and monitored for signs of end-organ damag e. If the patient has other cardiovascular risk factors and a nonemergent high-risk surgery is scheduled, surg ery may be delayed until a better control of the blood pressure values with oral medication [25, 26]. If seve re hypertension with signs of end- organ damage is present (hypertensive emergency), and there is no surgic al emergency, then surgery must be rescheduled and intravenous antihypertensive treatment should be admi nistered immediately.
There is no perfect antihypertensive treatment for hypertensive emergencies. The choice of drug depends mainly on the associated comorbidities [28, 29]. Patients should be carefully monitored during administrati on of antihypertensive treatment, in order to avoid signs of organs hypoperfusion.

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