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MODERN EMERGENCY CARE STRATEGY FOR HYPERTONIC CRISIS

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ABSTRACT

The article is devoted to discussing modern approaches to diagnosis and treatment in complicated and uncomplicated hypertensive crises. The options for antihypertensive drugs are considered depending on the nature of target organ damage in a hypertensive crisis. The data on the most frequently prescribed drugs for complicated and uncomplicated hypertensive crisis increases the volumetric velocity of coronary and cerebral blood flow and reduces the pressure in the pulmonary artery system. It is usually used to relieve the mild uncomplicated hypertensive crisis. Still, a wide range of side effects, including reflex tachycardia, periorbital and peripheral edema, skin redness, pruritus, limits its use.

Keywords: cerebral blood flow, routine clinical, hypertension, medical associations, hypertensive crisis.

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СОВРЕМЕННАЯ СТРАТЕГИЯ НЕОТЛОЖНОЙ МЕДИЦИНСКОЙ ПОМОЩИ ПРИ ГИПЕРТОНИЧЕСКОМ КРИЗИСЕ

АННОТАЦИЯ

Статья посвящена обсуждению современных подходов к диагностике и лечению при осложненном и неосложненном гипертоническом кризе. Рассмотрены варианты выбора антигипертензивных препаратов в зависимости от характера поражения органов-мишеней при гипертоническом кризе. Приведены данные о наиболее часто назначаемых лекарственных

средствах при осложненном и неосложненном гипертоническом кризе увеличивающих объемную скорость коронарного и мозгового кровотока, снижающих давление в системе легочной артерии. Обычно он используется для снятия легкого неосложненного гипертонического криза, но широкий спектр побочных эффектов, включая рефлекторную тахикардию, периорбитальный и периферический отек, покраснение кожи, зуд, ограничивает его использование.

Ключевые слова: мозговой кровоток, рутинная клиника, артериальная гипертензия, медицинские ассоциации, гипертонический криз.

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HIPERTONIK INQIROZ UCHUN ZAMONAVIY FAVQULODDA YORDAM STRATEGIYASI

ANNOTATSIYA

Maqola murakkab va asoratlanmagan gipertonik inqirozda diagnostika va davolashning zamonaviy yondashuvlarini muhokama qilishga bag'ishlangan. Gipertenziv dorilarni tanlash imkoniyatlari gipertonik inqiroz paytida maqsadli organlar zararlanishining xususiyatiga qarab ko'rib chiqiladi. Koronar va miya qon oqimining hajm tezligini oshiradigan, o'pka arteriya tizimidagi bosimni pasaytiradigan, murakkab va asoratlanmagan gipertonik inqiroz uchun eng ko'p buyurilgan dorilar haqidagi ma'lumotlar. Odatda u engil asoratlanmagan gipertonik inqirozni bartaraf etish uchun ishlatiladi, ammo keng ko'lamli yon ta'sirlar, shu jumladan refleksli taxikardiya, periorbital va periferik shish, terining qizarishi, qichishish, uning ishlatilishini cheklash.

Kalit so'zlar: miya qon oqimi, muntazam klinik, arterial gipertenziya, tibbiy uyushmalar, gipertonik inqiroz.

Introduction: Uncontrolled hypertension (UH) is a serious clinical problem that directly determines the nearest and remote patient prognosis (Ander - sen U.O., 2017). The results of observational, clinical and prospective studies have shown that adequate control of hypertension in routine clinical practice is the exception rather than the rule (Go A.S. et al., 2014; Janke A.T. et al., 2016). Only 10-15% of all hypertensive patients reach the target blood pressure (BP) level and can maintain it at this level for a long time (National Heart, Lung, and Blood Institute, 2003; CDC, 2011). As for 3 years, about 30% of all patients with uncontrolled hypertension die of stroke, terminal renal dysfunction or heart failure (Hoekstra J., Qureshi A., 2008; Heath I., 2016). Moreover, every 4th case of death in uncontrolled hypertension is associated with a hypertensive crisis (Vidt D.G., 2001; Mozaffarian D. et al., 2016).

Even though a single definition of a hypertensive crisis does not exist, the majority of experts from various medical associations (James, P.A. et al., 2014) agree that a hypertensive crisis can be defined as a state with a marked increase in blood pressure (> 180/110 mm Hg. Art .). This is accompanied by the appearance or aggravation of clinical symptoms associated with damage to target organs and requires a rapidly controlled blood pressure decrease (Chobanian A.V. et al., 2003).

The Working Group on Hypertension of the Ukrainian Society of Cardiology defines a hypertensive crisis as a sudden significant increase in blood pressure from a normal or elevated level, which is almost always accompanied by the appearance or intensification of disorders from the target organs or the autonomic nervous system (Parkhomenko A.N. et al., 2013) ...

It should be noted that not an established direct inter - connection between the severity of lesions of target organs and the absolute value of AD, although a sharp increase in blood pressure of normotensive level to 170 mm Hg. Art. and higher (for example, with eclampsia) is often accompanied by the development of a life-threatening situation (Gegenhuber A., Lenz K., 2003).

In addition, an isolated sharp increase in blood pressure, often to unusually high numbers for the patient, without subjective and objective clinical signs of target organ disorders, usually develops against the background of refusal of treatment or its temporary interruption, low compliance, when taking antihypertensive drugs in ineffective doses. , as well as as a result of the impact of traumatic factors, trauma, including burns, the influence of concomitant diseases (diabetes mellitus, thyroid dysfunction, pheochromocytoma, primary hyperaldosteronism, renovascular diseases, pregnancy), taking certain drugs (non-steroidal anti-inflammatory drugs, monoamine oxidase inhibitors, serotonin reuptake inhibitors), narcotic drugs (cocaine, amphetamine), alcohol or smoking abuse (Gegenhuber A., Lenz K., 2003). K factors that worsen the prognosis of hypertensive crisis usually referred longer duration hypertensive, elderly and senile age, increased creatinine and urea in the blood > 220 pmol / L and > 10 mmol / l, presence of severe hypertensive retinopathy (extravasal exudation and hemorrhage) (Varon J., Marik P.E., 2000; Vaughan C.J., Delanty N., 2000).

Thus, all cases of a sharp increase in blood pressure can be divided into states without an immediate threat to life (uncomplicated crisis) and life-threatening (complex crisis) (Phan D.G. et al., 2015). Most of the recommendations categorize only the last type of conditions in the category of "hypertensive crisis", defining cases with no immediate threat to the patient's life as hypertension, treated inadequately (Shafi T., 2004; Mancia G. et al., 2013). Nevertheless , from a practical point of view, the division of hypertensive crises into complicated (hypertensive emergency) and uncomplicated (hypertensive urgency) is quite rational, since it largely determines the doctor's tactics concerning the magnitude and rate of decrease in blood pressure, determining the routes of drug administration, and features of safety monitoring. and the effectiveness of drug therapy (Varon J., Marik PE, 2000; Vaughan C.J., Delanty N., 2000).

Materials and Methods: Principles of hypertensive crisis treatment. Treatment of emergency conditions in hypertension depends on the initial value of blood pressure, the presence and type of target organ damage, concomitant diseases and often ranges from expectant tactics to an aggressively controlled decrease in blood pressure to the target (Vaughan CJ, Delanty N., 2000). In most cases, with uncomplicated hypertensive crisis, it is recommended to provide a quick, but incomplete, decrease in blood pressure by at least 25% of the initial one within 24-48 hours, followed by dose adjustment of antihypertensive drugs for subsequent maintenance therapy (Berezin A.E., 2013 a; b). The medicaments can be administered orally or sublingually and hospitalization is not usually required (Berezin O.Є. 2016).

With the complicated hypertensive crisis, parenteral administration of drugs with a proven dose-dependent effect on blood pressure is necessary (Aggarwal M., Khan I.A., 2006). The rate of controlled decrease in blood pressure in a complicated hypertensive crisis is usually 15–25% of the initial value within 1–2 hours, then within 2–6 hours the blood pressure level should reach 160–150 / 100–90 mm Hg. Art. (Mancia G. et al., 2013; Weber M.A. et al., 2014). The subsequent maintenance therapy is necessary with the help of antihypertensive drugs - orally (Berezin AE, 2009). In all these situations, hospitalization of the patient is usually required for urgent indications (Weber M.A. et al., 2014). However, these general principles are not applicable to all situations considered as complicated hypertensive crisis

Table 1.

Rate of decrease and target blood pressure levels in patients with various complicated hypertensive crises

Comorbid state	Rate of BP decrease	Target level
Acute hypertensive encephalopathy	Reduction of average blood pressure by 25% within 8 hours	Installed individually. An acceptable level of systolic blood pressure may be <160 mmHg. Art.

Ischemic cerebral stroke	It is set individually if blood pressure is > 220/120 mm Hg. Art.	Not defined. For patients undergoing thrombolytic therapy, systolic blood pressure is <185 mm Hg. Art.
Hemorrhagic stroke	It is set individually if blood pressure is > 220/120 mm Hg. Art.	During the first 24 hours after the onset of symptoms with increased intracranial pressure, an average blood pressure of <130 mm Hg is maintained. Art. (systolic blood pressure <180 mm Hg), in patients without increased intracranial pressure, the mean blood pressure is maintained within <110 mm Hg. Art. (systolic blood pressure <160 mm Hg)
Subarachnoid hemorrhage	Decrease in blood pressure to the target level within 1 hour	Systolic blood pressure <140 mm Hg. Art. while maintaining intracranial angiospasm
Acute coronary syndrome / myocardial infarction	Decrease in mean blood pressure by 20–30% of baseline within 1 hour. Relative contraindication for thrombolytic therapy is blood pressure > 185/100 mm Hg. Art.	<140/90 mm Hg Art.
Acute heart failure / pulmonary edema	Decrease in blood pressure to the target level within 1 hour	<140/90 mm Hg Art.
Aortic dissecting aneurysm	Reduction of mean blood pressure by 25% of the initial during the first 5-10 minutes, and then - within 20-30 minutes to the target level	Systolic blood pressure 110–100 mm Hg. Art.
Eclampsia	Reduction in mean blood pressure by 20% of baseline within 12-24 hours	Not defined

With dissecting aortic aneurysm, a rapid decrease in mean blood pressure by 25% of the initial one is required during the first 5–10 minutes. Within 2 hours, the target systolic blood pressure, corresponding to 110–100 mm Hg, must be achieved. Art. (Gegenhuber A., Lenz K., 2003). In acute disorders of cerebral circulation, including cerebral infarction, the rate of decrease in blood pressure should be slow and determined individually (Slama M., Modeliar S.S., 2006). In this case, antihypertensive therapy is not carried out with systolic blood pressure <220 mm Hg. Art. and/or diastolic blood pressure <120 mm Hg. Art. The exception is patients undergoing thrombolytic therapy, for whom the target systolic blood pressure should be <185 mm Hg. Art. (James P.A. et al., 2014). In acute hypertensive encephalopathy, an immediate decrease in mean blood pressure by 20% of the baseline is required within 1 hour of medical care to achieve a target diastolic blood pressure <110 mm Hg. Art.

In general, recommendations for treating hypertensive crises are based on expert opinion since randomized clinical trials in this direction with a sufficiently high statistical power have not been carried out (British Columbia Ministry of Health, 2014).

Results and Discussions: Features of drug therapy in patients with complicated and uncomplicated hypertensive crisis. For uncomplicated hypertensive crisis, antihypertensive drugs are recommended (captopril, nifedipine, including in the form of slow release GITS, labetalol, urapidil), which provide a relatively gradual decrease in blood pressure within 24 hours, and can also be prescribed sublingually, which makes it possible to obtain an antihypertensive effect already in the first 10–20 minutes without a significant risk of hypoperfusion of target organs.

Captopril - the first fully synthetic angiotensin-converting enzyme (ACE) inhibitor - has a vasodilating effect, reducing afterload, pulmonary capillary wedge pressure and pulmonary vascular pressure; increases exercise tolerance; has reno- and cardioprotective, anti-ischemic

and weak diuretic effects (Slama M., Modeliar S.S., 2006). Captopril can reduce the mass of the left ventricular myocardium and prevent the onset and progression of heart failure. When taken sublingually at a dose of 12.5-25 mg, blood pressure decreases after 15-30 minutes and remains within 6-8 hours. The most common side effects are dry or unproductive persistent cough, tachycardia, headache, hypotension in orthostasis, skin itching, hyperkalemia, neutropenia. The drug is contraindicated in pregnant women with angio - neurotic edema, bilateral renal artery stenosis and severe renal insufficiency.

Nifedipine GITS - a dihydropyridine derivative of calcium channel blockers, has a vasodilating effect, a moderate negative chronotropic effect, increases coronary and cerebral blood flow volumetric velocity and reduces pulmonary pressure artery system. It is usually used to relieve the mild, uncomplicated hypertensive crisis. Still, a wide range of side effects, including reflex tachycardia, periorbital and peripheral edema, skin redness, pruritus, limit its use (Phan D.G. et al., 2015).

Clonidine is a fairly old and well-studied drug-related to peripheral α-adrenoreceptor blockers with central α-agonistic and peripheral anticholinergic effects (Slama M., Modeliar S.S., 2006). The drug has lost its significance as the main drug to relieve the hypertensive crisis, although the current clinical guidelines provide this possibility (Phan D.G. et al., 2015).

In a complicated hypertensive crisis, drugs administered parenterally must satisfy the main condition for the provision of emergency medical care, namely, to provide a dose-dependent controlled decrease in blood pressure (Feldstein C., 2007; Ardigo S. et al., 2008). If monotherapy is ineffective, various combinations of drugs are possible (Berezin O.Y., 2016).

Sodium nitroprusside is a powerful venous and arterial vasodilator with a fast-onset effect (within a few seconds), the first-line drug for most urgent clinical situations associated with the development of complications of uncontrolled hypertension (Murphy C., 1995). Its administration is carried out by titration with an individual dose selection, which requires constant monitoring of blood pressure (ideally, direct invasive measurement). The main indications for the appointment of sodium nitroprusside are acute hypertensive encephalopathy, acute or acutely decompensated heart failure, dissecting aortic aneurysm, hyperadrenergic conditions (Pergolini M.S., 2009). Since the main metabolite of the drug is thiocyanate, the duration of continuous intravenous infusion can be preventively limited to 48–72 hours, especially in patients with renal and hepatic insufficiency. Thiocyanate intoxication manifests by nausea, vomiting, muscle cramps, decreased superficial and tendon reflexes, disorientation, and sometimes psychosis. In these cases, sodium thiosulfate is recommended as an emergency. Sodium nitroprusside in high doses can increase intracranial pressure, limiting its use in patients with cerebrovascular diseases, traumatic brain injury, and cranial operations (Phan D.G. et al., 2015). It must be borne in mind that the drug has a pronounced irritant effect when it gets under the skin and sometimes causes subcutaneous necrosis.

Nitroglycerin is a powerful peripheral, predominantly venous (in low doses) vasodilator that reduces pre- and afterload, increases coronary volumetric blood flow and perfusion (Wilson SS et al., 2017). Nitroglycerin appears to be the best drug for relieving hypertensive crisis complicated by acute coronary syndrome, myocardial infarction, pulmonary edema or acute heart failure (Berezin A., 2015; Wilson S.S. et al., 2017). In addition, it is most often used to achieve adequate blood pressure control in patients with hypertensive crises in the postoperative period after coronary artery bypass grafting or other cardiac/vascular surgery, including angioplasty for dissecting aortic aneurysms (Sun S.H. et al., 2016). Tolerance to nitroglycerin begins to develop after 24–48 hours of continuous slow infusion, which may have serious clinical significance (Phan D.G. et al., 2015). The drug is contraindicated in many cerebrovascular diseases accompanied by increased intracranial pressure, including intracranial hemorrhages, as well as in angle-closure glaucoma (Elliott W.J., 2004).

Nicardipine - refers to dihydropyridine blockers of slow calcium channels with a relatively rapidly emerging antihypertensive effect of moderate duration (Dahlöf B., 2009). Nicardipine is often used in patients with cerebrovascular disease or people with hypertensive crises during the perioperative period. A drug interaction has been described between nicardipine and some inhaled

anesthetics (Elliott W.J., 2004). Among the most common side effects are headache, dizziness, periorbital and peripheral edema, skin redness and itching, which are typical for many representatives of this class of drugs (Berezin A.E., 2015).

Nimodipine is a typical representative of short-acting dihydropyridine derivatives of slow calcium channels. The drug is reserved to relieve hypertensive crises accompanied by subarachnoid hemorrhage and intracranial vasospasm (Etminan N., Macdo - nald R. L., 2017; Hockel K. et al, 2017.). There are at least two randomized clinical trials (Pickard J.D. et al., 1989; Hänggi D. et al., 2015) and a meta-analysis by N. Etminan et al. (2011) that demonstrated a beneficial effect prolonged nimodipine infusion on survival and the risk of repeated intracranial hemorrhage. (Kumar A. The, Pha - lak M., 2017).

Fenoldopam - selective agonist of dopaminergic receptors first subtype responsible for arterio - lar vasodilation, natriuresis and diuresis (Murphy M.B. et al, 2001.). These qualities of the drug are most in demand in patients with hypertensive crisis complicated by acute kidney injury. Fenoldopam has a rapid antihypertensive effect, does not require invasive blood pressure monitoring, does not require dose titration and does not cause withdrawal syndrome (Feldstein C., 2007). In terms of effectiveness, fenoldopam and sodium nitroprusside are very close; however, the ease of administration of fenoldopam is its indisputable advantage. The main candidates for treatment with fenoldopam are patients with hypertensive crisis complicated by acute renal injury or persons with previously verified chronic kidney disease (Murphy C., 1995). The most important contraindication to the use of fenoldopam is glaucoma, and among the side effects, headache, dizziness, skin redness, pruritus, tachycardia/bradycardia, hypokalemia, thrombophlebitis of peripheral veins are most often noted.

Labetalol - nonselective blocker of β- and α_1 -adreno - receptors (at a ratio of 3-7: 1), wherein the rapid development of therapeutic effect, persisting for over 2-12 hours, and low toxicity (Feldstein C., 2007). The drug reduces the peripheral vascular resistance without reactive sympathetic stimulation and not require intravascular monitor BP values (Henny-Fullin K. e t al., 2015). The use of labetalol in hypertensive crises is most justified in developing acute hypertensive encephalopathy, stroke, and hyperadrenal conditions (Henry C.S. et al., 2004). In this case, the drug is contraindicated in acute heart failure, high-grade intracardiac blockade, bronchial asthma and chronic obstructive pulmonary disease.

Esmolol is an ultra-short, highly selective β_1 -adrenergic receptor blocker without intrinsic sympathomimetic activity, which is approved by the Food and Drug Administration (FDA) exclusively for the relief of perioperative hypertensive crisis, since its use requires intra-arterial blood pressure monitoring. Theoretically, if intra-arterial blood pressure monitoring is provided, then the drug can be prescribed for acute coronary syndrome / myocardial infarction, acute hypertensive encephalopathy, pheochromocytoma, dissecting aortic aneurysm (Elliott W.J., 2004). It should be noted that esmolol often causes thrombophlebitis of peripheral veins, and its accidental penetration under the skin leads to local necrosis of the subcutaneous tissue (Feldstein C., 2007). The drug can not be used in patients using cocaine or amphetamines, as well as in those with acute heart failure, chronic obstructive pulmonary disease, bronchial asthma and high-grade intracardiac blockade (Henny-Fullin K. et al., 2015).

Phentolamine is a competitive non-selective blocker of α-adrenergic receptors. The use of which in hypertensive crisis is limited to a hyperadrenal state that develops due to drug interactions or pheochromocytoma (Dieterle T. et al., 2001). Intravenous bolus administration of the drug provides an immediate decrease in blood pressure by 5-10 mm Hg. Art. Simultaneously, the high risk of hypotension in orthostasis requires certain caution when using it (Feldstein C., 2007).

Hydralazine is a direct arteriolar vasodilator with the potential to improve placental blood flow (Duley L., 2003). This feature of the drug is the rationale for its use in eclampsia and preeclampsia, although the high frequency of unwanted side effects, including severe sympathetic stimulation, fluid retention, headache, skin redness, tachycardia, nausea and vomiting, significantly limit its clinical use (Henry CS et al. ., 2004). Moreover, the drug is prohibited for use

in patients with high cardiovascular risk and persons with established cardiovascular disease (Henny-Fullin K. et al., 2015).

Urapidil is an α_1-adrenergic receptor blocker to stimulate serotonin 5-HT $_{1A}$ receptors of the vasomotor center. The drug helps to reduce peripheral vascular resistance without reflex tachycardia and a decrease in cardiac output. A feature of urapidil is an extremely low frequency of hypotension in orthostasis, even in elderly and senile patients (Yang W. et al., 2017). The main indication for the use of urapidil is the relief of a hypertensive crisis, especially associated with a hyperadrenal state, cerebrovascular diseases, eclampsia, dissecting aortic aneurysm (Wacker J. et al., 1999; Diemunsch P. et al., 2015). Contraindications to the use of urapidil are aortic stenosis, pregnancy and lactation, patent ductus arteriosus, hypersensitivity to the drug.

Enalaprilat is an injectable form of enalapril maleate, recommended exclusively for controlled hypotension to relieve hypertensive crisis, mainly associated with the occurrence of acute hypertensive encephalopathy or heart failure (Ayaz S.I. et al., 2016; Lipari M. et al., 2016). The drug is administered at a dose of 1.25-5 mg intravenously bolus, the effect develops after 15 minutes and lasts up to 6 hours. Like ACE inhibitors, enalaprilat has class-specific contraindications that limit its use in pregnant women, patients with bilateral renal artery stenosis, severe renal dysfunction, hyperkalemia and angioedema.

Loop diuretics are often used to relieve various hypertensive crises. In fact, diuretics can be used to treat refractory, malignant hypertension and uncomplicated hypertensive crisis. The main argument against an initial purpose of this class of drugs in complicated hypertensive crises is no projected antihypertensive effect, in connection with which they are not suitable for controlled hypotension (Die - terle T. et al, 2001.). Current clinical guidelines do not recommend considering loop diuretics as the main component of treatment for complicated hypertensive crisis (Mancia G. et al., 2013; Murphy C., 2015; Phan D.G. et al., 2015).

Kaptopres-Darnitsa is a combined antihypertensive drug containing a dosed combination of an ACE inhibitor captopril (50 mg) and hydrochlorothiazide (25 mg). Both active substances included in the fixed combination have a fairly solid evidence base in the treatment of hypertension (Souvirón Rodríguez A., Martínez Morillo M., 1992; Luccioni R. et al., 1995; Waeber B. et al. 1995). Kaptopres-Darnitsya possesses therapeutic bioequivalent with respect to the original drug comparison and is recommended for the initial treatment and maintenance treatment with mild to moderate hypertension with a view to achieving optimum control of blood pressure, decrease cardiac risk - Vascular events including hypertensive crises, improving the quality and duration of life, but also can be used in the relief of uncomplicated hypertensive crises, including as a component of responsible self-medication (Ferroni C. et al., 1992; Klein G., 1998). The initial dose may be ½ tablet (25 mg captopril and 12.5 mg hydro - chlorothiazide) 1 times a day. The therapeutic effect appears after 30-60 minutes and lasts for 6-12 hours and sometimes more. In case of insufficient effectiveness, the dose can be doubled. In renal dysfunction (glomerular filtration rate> 30 ml / min / 1.73 m ^{2}), it is recommended to reduce the dose of the drug by half. With severe renal failure, during pregnancy, with bilateral renal artery stenosis, angioedema in the anamnesis, Kaptopres-Darnitsa is not used.

Conclusion:

In general, the drug has a good efficacy profile, an acceptable safety spectrum and a fairly democratic cost, which makes it one of the most affordable drugs for the initial treatment of mild / moderate hypertension. Kaptopres-Darnitsa can be recommended for the relief of uncomplicated hypertensive crisis, including situations involving responsible self-medication, as well as as the main drug in monotherapy or in combination for initial therapy and long-term maintenance treatment of hypertension.

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