STOJAK, Łukasz, GREGO, Mateusz, BACZEWSKI, Mateusz, POPIELA, Dariusz, URBAŃSKA, Karina, GREGO, Katarzyna, KWIATKOWSKI, Filip and CZYŻ, Witold. The Use of Benzodiazepines in the Management of Hypertensive Crisis: A Literature Review. Quality in Sport. 2025;37:57003. eISSN 2450-3118.
https://doi.org/10.12775/QS.2025.37.57003
https://apcz.umk.pl/QS/article/view/57003

The journal has been 20 points in the Ministry of Higher Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Higher Education and Science of 05.01.2024. No. 32553.
Has a Journal's Unique Identifier: 201398. Scientific disciplines assigned: Economics and finance (Field of social sciences); Management and Quality Sciences (Field of social sciences).
Punkty Ministerialne z 2019 - aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 r. Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398.
Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych).

The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 14.12.2024. Revised: 20.12.2024. Accepted: 10.01.2025. Published: 10.01.2025.

The Use of Benzodiazepines in the Management of Hypertensive Crisis: A Literature Review

STOJAK Łukasz, GREGO Mateusz, BACZEWSKI Mateusz, POPIELA Dariusz, URBAŃSKA Karina, GREGO Katarzyna, KWIATKOWSKI Filip, CZYŻ Witold.

lek. Łukasz Stojak,
10th military clinical hospital with polyclinic ul. Powstańców Warszawy 5, 85-681 Bydgoszcz, Department of Normal Anatomy, Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Torun, ul. Łukasiewicza 1, 85-821 Bydgoszcz, Poland
e-mail: luk.stojak@gmail.com
ORCID: https://orcid.org/0009-0008-9910-0445

lek. Mateusz Grego,
10th Military Clinical Hospital with Polyclinic ul. Powstańców Warszawy 5, 85-681 Bydgoszcz, Poland
e-mail: mateuszgrego@onet.eu
ORCID: https://orcid.org/0009-0008-4079-2168

lek. Mateusz Baczewski,
10th military clinical hospital with polyclinic ul. Powstańców Warszawy 5, 85-681 Bydgoszcz, Poland
e-mail: mateuszxbaczewski@gmail.com
ORCID: https://orcid.org/0009-0007-2857-5219

lek. Dariusz Popiela,
Military Institute of Aviation Medicine, Krasińskiego 54/56 Street, 01-755 Warsaw, Poland,
e-mail: dariusz.popiela1@gmail.com
ORCID: https://orcid.org/0009-0009-8648-2365

lek. Karina Urbańska,
Central Teaching Hospital of the Medical University of Lodz located at ul. Pomorska 251, 92-213 Lodz, Poland
e-mail: karina.urbanska2@gmail.com
ORCID: https://orcid.org/0000-0002-1981-9281

lek. Katarzyna Grego,
10th Military Clinical Hospital with Polyclinic ul. Powstańców Warszawy 5, 85-681 Bydgoszcz, Poland
e-mail: k.grego521@gmail.com
ORCID: https://orcid.org/0009-0005-7388-8885

lek. Filip Kwiatkowski,
Military Institute of Aviation Medicine, Krasińskiego 54/56 Street, 01-755 Warsaw, Poland
e-mail: filip.karol.kwiatkowski@gmail.com
ORCID: https://orcid.org/0009-0006-3873-1265

dr n. med. Witold Czyż,
Central Teaching Hospital of the Medical University of Lodz located at ul. Pomorska 251, 92-213 Lodz, Poland
e-mail: witoldczyz@googlemail.com
ORCID: https://orcid.org/0009-0006-4442-9900

Abstract

Hypertensive crisis is a medical emergency that requires urgent pharmacological intervention to prevent organ damage. The pathogenesis of this condition is often linked to excessive sympathetic nervous system activation resulting from a strong stress response. Benzodiazepines, as a class of drugs with anxiolytic and sedative effects mediated through GABA-A receptor modulation, can effectively target the underlying cause of a sudden rise in blood pressure while indirectly contributing to its reduction. This study presents a literature review on the use of benzodiazepines in the treatment of hypertensive crises, with a focus on their mechanisms of action and the limitations associated with their use.

The analysis indicates that benzodiazepines, in specific patient groups, can effectively reduce psychological stress and facilitate hemodynamic stabilization. However, the potential risk of adverse effects, such as respiratory depression, must be considered. Benzodiazepines should be used with caution as a therapeutic option in hypertensive crisis management.

Aim of the study:

The aim of this study is to analyze the role of benzodiazepines in the management of hypertensive emergencies. The review aims to gather information on the mechanisms of action of these drugs, clinical indications, potential benefits and limitations of their use.

Materials and methods:

A systematic review of scientific and medical literature from the PubMed and Google Scholar databases was conducted.

Conclusions:

The review results indicate that benzodiazepines can play a significant role in the management of hypertensive emergencies, particularly in cases associated wit stress, anxiety or autonomic dysregulation. Their mechanism of action, primarily involving the modulation of the central nervous system, allows for effective reduction of sympathetic overdrive, which can contribute to elevated blood pressure levels.

While benzodiazepines are not first-line agents for direct blood pressure reduction, their use as adjuncts to other antihypertensive therapies can improve patient outcomes in specific scenarios. However, their application requires caution due to potential side effects such as sedation or respiratory depression.

Further research is needed to establish standardized protocols for their use in hypertensive crises and identify patient populations that may benefit the most from this therapeutic approach.

Keywords: arterial hypertension; hypertensive crisis; benzodiazepines; blood pressure control; acute hypertension treatment

Introduction

In the era of civilizational progress, societies face numerous health challenges, including obesity, diabetes, and hypertension. The accelerating pace of life, geopolitical tensions, such as the ongoing war beyond Poland's borders, and the COVID-19 pandemic have contributed to persistently high-stress levels among the population. Despite numerous public health campaigns and the promotion of healthy lifestyles, over 1.3 billion adults worldwide were living with hypertension in 2019, a condition associated with significant economic costs and limited access to medical care in many countries [1].

According to data from Statistics Poland (GUS), over 500,000 deaths occurred in Poland in 2021, with cardiovascular diseases accounting for nearly 35% of all fatalities.

The body's response to stress involves a series of mechanisms aimed at adapting to prevailing conditions. These mechanisms are not limited to physical stressors such as hunger, heavy physical exertion, or extreme temperatures but also include psychological factors. Psychomotor agitation or anxiety can trigger excessive activation of the sympathetic nervous system, potentially resulting in a sudden spike in blood pressure [2].

In conventional hypertension management, various drug classes target specific physiological components. However, in patients whose sudden blood pressure elevations are stress-induced, benzodiazepines may be considered as an alternative to standard therapy [3].

Hypertensive Crisis

A hypertensive crisis is an acute condition characterized by a sudden and significant increase in blood pressure, typically exceeding 179/119 mmHg. Such an abrupt and severe elevation can result in organ damage, including hypertensive encephalopathy in the brain, myocardial infarction in the heart, acute renal failure in the kidneys, or damage to the retina. This state necessitates immediate medical intervention to minimize the risk of severe complications, including patient mortality [4, 5].

Hypertensive crises can be further classified into two categories:

Hypertensive Urgency: A critical rise in blood pressure without acute organ damage.

Hypertensive Emergency: A life-threatening state with significant organ damage [6].

Scientific literature highlights notable threshold differences for defining this condition, particularly concerning diastolic pressure. Therefore, in addition to absolute blood pressure values, the rate of pressure increase and clinical symptoms must be considered. Among patients with chronic hypertension, a sudden rise in blood pressure below the defined threshold may still cause significant organ damage [7].

These variations also depend on age, sex, and comorbid conditions. For instance, older adults may experience organ complications at lower blood pressure levels due to increased vascular stiffness and reduced cardiovascular adaptability. Similar observations have been reported in patients with diabetes or chronic kidney disease [8–10].

A hypertensive crisis requires prompt clinical assessment and blood pressure measurement to determine an appropriate treatment strategy. Therapeutic decisions should be based not only on blood pressure values but also on a comprehensive patient evaluation, including comorbid conditions and presenting clinical symptoms.

Classification of Hypertensive Crisis

As previously mentioned, the diagnosis of a hypertensive crisis requires attention not only to blood pressure values but also to the patient’s clinical status. The literature identifies two main classifications of sudden blood pressure elevation, which determine the treatment approach and prognosis for the patient:

Hypertensive Urgency

Hypertensive urgency is defined as a severe elevation in blood pressure, typically exceeding 179/119 mmHg, without acute organ damage. Nonspecific symptoms, such as anxiety, headaches, dizziness, nausea, or vomiting, may be present, but they do not pose an immediate threat to life. This condition generally does not require hospitalization but necessitates prompt treatment to prevent complications [8, 10, 11].

The primary goal of therapy is to gradually lower blood pressure over 24–48 hours to reduce the risk of ischemic organ damage. This treatment is typically conducted in an outpatient setting using oral medications administered by emergency medical teams, emergency department staff, or in urgent care settings. Commonly used drugs include ACE inhibitors such as captopril [10, 12].

Hypertensive Emergency

Hypertensive emergency involves a critical rise in blood pressure, usually exceeding 179/119 mmHg, accompanied by symptoms of acute organ damage. These injuries are often reversible but require immediate intervention and a carefully planned treatment strategy to minimize the risk of permanent complications, including death [9, 13].

In managing hypertensive emergencies, immediate blood pressure reduction is necessary, often achieved through intravenous medications. The rate of pressure reduction must be carefully controlled to prevent ischemic organ damage, particularly in the brain. Recommendations for the speed of blood pressure reduction vary based on the clinical scenario and organ damage present (Table 1) [14, 15].

Key Considerations for Management

- **Hypertensive Urgency:** Gradual reduction in blood pressure over 24–48 hours, typically managed with oral antihypertensives.
- **Hypertensive Emergency:** Immediate reduction in blood pressure with intravenous medications, with close monitoring to prevent ischemic complications.

This classification underscores the importance of tailoring treatment strategies to each patient's specific clinical presentation and underlying pathophysiology.

Clinical Scenario	Target BP Reduction	Time Frame
Hypertensive Encephalopathy	Reduce MAP by 20-25%	Within 2 hours
Aortic Dissection	SBP < 120 mmHg	Within 20 minutes
Ischemic Stroke	Lower BP if SBP > 220 mmHg or DBP > 120 mmHg	Gradually over 24-48 hours
Hemorrhagic Stroke	Lower SBP to < 140 mmHg if initial SBP is 150-220 mmHg	Within 1 hour
Myocardial Infarction	Gradual reduction of MAP	Within 24 hours
Acute Renal Failure	Reduce MAP by 20-25%	Within 2 hours

Selected Medications and Their Mechanisms of Action

Sodium Nitroprusside

Sodium nitroprusside is a potent vasodilator that releases nitric oxide (NO), which activates guanylyl cyclase (cGMP) in vascular smooth muscle cells. Increased cGMP levels reduce calcium ion availability in muscle cells, leading to smooth muscle relaxation and vessel dilation. This mechanism decreases peripheral vascular resistance and lowers blood pressure [16].

Captopril

Captopril, an angiotensin-converting enzyme (ACE) inhibitor, blocks the activity of ACE, preventing the conversion of angiotensin I to angiotensin II. Angiotensin II typically causes vasoconstriction by stimulating smooth muscle contraction in blood vessels. Reduced angiotensin II levels also inhibit aldosterone secretion, promoting sodium and water excretion, which lowers blood volume and blood pressure. Additionally, captopril increases bradykinin levels, a peptide mediator that promotes vasodilation by stimulating nitric oxide and prostacyclin production. Collectively, these mechanisms contribute to blood pressure reduction [17]. Clinical studies on captopril's administration routes have yielded mixed results. In a 2016 study, sublingual administration resulted in a faster and greater reduction in systolic and mean arterial pressure compared to oral administration, especially within the first 30 minutes post-dose [18]. However, earlier research from 2012 found no significant difference between the two methods [19].

Nitroglycerin

Nitroglycerin, an organic nitrate, works through an enzymatic reaction in vascular smooth muscle cells, where it is metabolized by mitochondrial aldehyde dehydrogenase. This process releases nitric oxide, which activates guanylyl cyclase, increasing cyclic guanosine monophosphate (cGMP) levels. Elevated cGMP levels cause smooth muscle relaxation and vasodilation [20].

Furosemide

Furosemide, a loop diuretic, acts on the ascending limb of the loop of Henle in the nephron. It inhibits the Na+/K+/2Cl- cotransporter, reducing the reabsorption of sodium, potassium, and chloride ions into the epithelial cells. This disruption of the osmotic gradient increases water excretion along with electrolytes, resulting in decreased blood volume and blood pressure [21].

Urapidil

Urapidil combines two mechanisms of action: antagonism of α_1-adrenergic receptors and stimulation of central serotonin 5-HT_1A receptors. Blocking α_1-adrenergic receptors in vascular smooth muscle induces vasodilation, reducing peripheral vascular resistance and blood pressure. Simultaneously, stimulation of central 5-HT_1A receptors decreases sympathetic nervous system activity and vascular smooth muscle tension induced by sympathetic impulses [22].

These drugs represent diverse mechanisms for managing hypertensive crises, allowing treatment to be tailored to the clinical scenario and patient needs.

The Impact of Stress on Increased Sympathetic Nervous System Activity

Stress is an inherent part of human life and plays a critical role in activating the sympathetic nervous system (SNS), which is particularly significant in the context of hypertensive crises. During stressful situations, the body initiates adaptive mechanisms in which the SNS assumes a central role. It is responsible for the "fight or flight" response, mobilizing the body for action. Activation of the SNS leads to increased release of catecholamines, such as adrenaline and noradrenaline, which result in:

- Increased heart rate (tachycardia),
- Enhanced myocardial contractility,
- Redistribution of blood flow to skeletal muscles and the brain,
- Bronchodilation,
- Elevated blood glucose levels,
- Increased arterial blood pressure.

These physiological changes prepare the body to endure adverse conditions [23–25].

The hypothalamus is the key organ in mediating and adapting the body's response to stress. Stress triggers the heightened release of various hormones, including adrenocorticotropic hormone (ACTH), glucocorticoids, and vasopressin. Key reactions include activation of the hypothalamic-pituitary-adrenal (HPA) axis, inhibition of vagal tone, and stimulation of the SNS [4].

A stress stimulus activates neurons in the parvocellular region of the paraventricular nucleus, leading to corticotropin release, subsequently triggering ACTH secretion from the pituitary gland into the bloodstream. ACTH acts on the adrenal cortex to increase serum glucocorticoid levels.

In their study on cortisol release during moderate psychological stress, Mark Hamer and Andrew Steptoe investigated its effects in a group of 509 participants. They found that 15.9% of the subjects experienced a brief episode of hypertension. The authors concluded that elevated cortisol levels may contribute to hypertensive episodes in individuals predisposed to hypertension [27].

Another stress-related response involves the release of opioid neuropeptides, such as beta-endorphins, from the pituitary gland and arcuate nucleus neurons in the hypothalamus. Beta-endorphins play an analgesic role. Additionally, stress stimulates noradrenergic neurons in the locus coeruleus and increases dopamine release. In severe stress, excess noradrenaline, dopamine, and serotonin can alter sensory processing and dendritic impulse conduction. Serotonin enhances glucocorticoid effects on hippocampal neurons, further contributing to the stress response [28].

Understanding these mechanisms underscores the profound impact of stress on blood pressure regulation, particularly in the context of hypertensive crises. This highlights the importance of addressing stress in therapeutic strategies aimed at managing hypertension.

Benzodiazepines

One potential cause of hypertensive crises is excessive sympathetic nervous system activation triggered by psychological or physical stress [9]. Addressing such triggers requires a treatment approach that not only alleviates symptoms but also targets the underlying cause.

In this context, benzodiazepines - well-known for their sedative and anxiolytic properties - have a therapeutic role in managing hypertensive crises.

Stress plays a significant role in the pathogenesis of hypertensive crises by amplifying the activity of the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system. Physiological responses to such activation include increased levels of circulating catecholamines, leading to elevated vascular resistance, tachycardia, and consequently, heightened arterial blood pressure [29]. Anxiety, fear, or anger can further exacerbate these processes, making stress management a critical component of causal therapy for hypertensive crises.

Benzodiazepines, with their anxiolytic, sedative, and muscle-relaxant effects, act on GABA-A receptors, dampening excessive central nervous system activity, including that of autonomic regulation centers such as the hypothalamus and brainstem [30]. This mechanism makes benzodiazepines particularly effective in reducing sympathetic overactivity and lowering emotional tension, thereby indirectly lowering blood pressure.

Due to their rapid and effective action, benzodiazepines are especially useful in cases where hypertensive crises are stress-induced. Their application - whether as monotherapy or adjunctive therapy - can significantly enhance treatment efficacy, reducing the risk of organ complications and improving overall outcomes.

Mechanism of Action of Benzodiazepines

Benzodiazepines are agonists of GABA-A receptors, which play a crucial role in inhibiting neuronal activity in the central nervous system (CNS). Their mechanism of action can be broken down into several key stages:

Interaction with GABA-A Receptors

GABA-A receptors are ionotropic receptors composed of five subunits that form a chloride ion channel. Benzodiazepines bind at the interface of the α and γ subunits of the receptor, enhancing its affinity for gamma-aminobutyric acid (GABA), the primary inhibitory neurotransmitter in the CNS [31].

Enhancement of Chloride Ion Current

When GABA binds to the receptor, the ion channel opens, allowing chloride ions to flow into the neuron. Benzodiazepines amplify this effect by increasing the flow and duration of chloride ion influx. This hyperpolarizes the neuronal membrane, making it less susceptible to depolarization and the generation of action potentials [32].

Macroscopic Effects

Through the modulation of GABA-A receptors, benzodiazepines produce a wide range of effects:

- **Anxiolysis:** Inhibition of neuronal activity in structures associated with anxiety processing, such as the amygdala [30].
- **Sedation:** Reduction in activity of neurons within the brainstem reticular formation, leading to calmness and drowsiness [33].
- **Muscle Relaxation:** Decrease in skeletal muscle tension through the inhibition of motor neurons in the spinal cord [32].

- **Anticonvulsant Action:** Suppression of excessive electrical activity and stabilization of epileptogenic foci [34].

Role in Hypertensive Crises

While benzodiazepines lack direct antihypertensive properties, they can effectively reduce blood pressure by attenuating sympathetic nervous system activity. By decreasing neuronal activity in regions such as the hypothalamus and brainstem, benzodiazepines reduce the release of catecholamines (adrenaline and noradrenaline) from the adrenal glands. This lowers peripheral vascular resistance and heart rate [29]. Furthermore, their anxiolytic effects diminish emotional stress, further reducing activation of autonomic centers.Clinical studies document reductions in blood pressure following benzodiazepine use, such as with estazolam in patients with chronic insomnia [35, 36].

Paradoxical Effects

Despite their general efficacy, benzodiazepines may paradoxically increase heart rate, potentially leading to tachycardia. This compensatory response may result from vasodilation-induced hypotension, prompting the body to increase cardiac output [37, 38]. Additionally, paradoxical reactions, including heightened nervous system activity, anxiety, and elevated blood pressure, can occur in some patients [32].

In summary, benzodiazepines effectively target sympathetic overactivity in hypertensive crises, although their use requires careful monitoring due to potential compensatory or paradoxical responses.

Limitations and Precautions in the Use of Benzodiazepines

Despite their extensive use in medicine, benzodiazepines are not without risks and potential adverse effects.

Respiratory Depression

Benzodiazepines act on GABA-A receptors in neurons of the medulla oblongata and pons, which are critical for respiratory rhythm regulation. By enhancing the inhibitory action of GABA, these drugs reduce the activity of neurons responsible for generating and modulating respiratory signals. This can impair the respiratory center's response to hypercapnia (elevated carbon dioxide levels) and hypoxia (reduced oxygen levels), leading to a decrease in respiratory rate and depth [39].

Impact on Clinical Monitoring

The sedative effects of benzodiazepines may complicate the clinical evaluation and ongoing monitoring of patients. Reduced responsiveness or altered consciousness can mask underlying conditions, delay diagnosis, or hinder timely interventions.

Key Considerations for Use

While benzodiazepines can be valuable in managing hypertensive crises, particularly those with a stress-related component, their potential to induce respiratory depression and complicate clinical assessments necessitates cautious use. Patients should be carefully monitored, particularly those at risk for respiratory compromise or those requiring precise neurological evaluation.

Discussion

Hypertensive crisis represents a sudden and severe elevation in blood pressure that can result in critical organ damage, necessitating rapid management and comprehensive patient care. Psychological or physical stress is one of the key factors triggering excessive sympathetic nervous system activation, which contributes to the abrupt rise in blood pressure.

In the management of hypertension, a wide range of pharmacological options is available. These include various antihypertensive drug classes with distinct mechanisms of action, allowing treatments to be tailored to the patient's medical history and clinical condition. This personalized approach ensures effective and relatively safe management of hypertensive crises. However, given the multiple possible causes of hypertensive crises, a comprehensive patient assessment is critical to identifying the underlying trigger and implementing therapy that restores physiological balance while addressing accompanying symptoms.

In stress-induced hypertensive crises, medications that decrease central nervous system activity and secondarily inhibit sympathetic responses are a rational therapeutic approach. Although benzodiazepines lack direct antihypertensive properties, they are effective in reducing emotional tension and anxiety. By improving the balance between sympathetic and parasympathetic activity, benzodiazepines can play a critical role in managing stress-induced hypertensive crises.

Their anxiolytic effects, combined with their ability to decrease sympathetic overactivity, make benzodiazepines a valuable tool in addressing the pathophysiological mechanisms underlying these crises. This approach not only mitigates stress-related triggers but also complements other antihypertensive therapies, contributing to improved patient outcomes.

Benzodiazepines

Benzodiazepines, as a drug class, have a relatively rapid onset of action, making them useful in acute situations. The literature describes cases of successful use of benzodiazepines as part of adjunctive therapy in hypertensive crises.

In 2005, a study was published comparing the effects of oral diazepam and captopril in a double-blind trial involving thirty-six 60-year-olds who presented to the emergency department with elevated blood pressure (above 200/100 mmHg). The blood pressure-lowering effects were found to be similar in both groups [40].

In the same year, a study conducted in Brazil involved 100 patients with elevated blood pressure who presented to the emergency department with symptoms of high blood pressure (SBP between 180–200 mmHg and/or DBP between 110–120 mmHg). The patients were divided into two groups: one received treatment with metamizole or diazepam, and the other with captopril. Both groups demonstrated similar efficacy in lowering blood pressure [41].

In 2020, a group of researchers from Croatia analyzed data on the use of benzodiazepines in hypertensive crises in selected healthcare facilities over one year. Among 144 patients included in the study, a control group was created consisting of 52 patients with elevated blood pressure without hypertensive crises and a study group of 92 patients meeting the criteria for hypertensive crises (SBP above 180 mmHg and/or DBP above 120 mmHg).
Patients with hypertensive crises who were treated with diazepam, either as monotherapy or in combination with other drugs, experienced a significantly greater reduction in systolic blood pressure (21.9% ± 5.2%) compared to the control group (17.9% ± 7.9%, p=0.03). Furthermore, in the group treated with diazepam, there were fewer referrals for further hospitalization (3% vs. 22%, p=0.013), suggesting more effective management of hypertension in outpatient settings. The largest reduction in blood pressure (23.6% ± 3.9%) was observed in the group that received a combination of nitrates and benzodiazepines, highlighting the synergistic effects of these drugs in reducing sympathetic activation and peripheral vascular resistance [42].
These findings indicate that diazepam, as part of a combination therapy strategy, may be an effective and safe option for treating patients with hypertensive urgencies, especially those where stress or excessive sympathetic nervous system activation is a significant factor.

Conclusions

The use of benzodiazepines in the management of hypertensive crises remains a controversial topic in emergency medicine. As demonstrated in this study, benzodiazepines may serve as an effective tool in the treatment of hypertensive crises, particularly in patients where excessive sympathetic activation due to stress is a primary trigger for a sudden increase in blood pressure. Their anxiolytic effects and ability to inhibit sympathetic activity can lead to significant blood pressure reductions.
Research has shown that the administration of benzodiazepines facilitates blood pressure lowering, and their combination with other antihypertensive agents can enhance therapeutic efficacy and reduce the need for hospitalization. This approach has the potential to alleviate the burden on healthcare systems while providing direct benefits to patients.
The use of benzodiazepines as part of a therapeutic strategy for hypertensive crises is safe, provided contraindications such as respiratory depression or the risk of dependency are considered.
A significant advantage is the feasibility of administering these therapies in outpatient settings, enabling effective treatment without requiring referral to emergency departments or hospital admissions.
Nevertheless, further research is needed to explore the synergistic effects of benzodiazepines with other antihypertensive agents and to develop standardized protocols that incorporate benzodiazepines as a component of pharmacological management in hypertensive crises.

Author's contributions:
Conceptualization, Łukasz Stojak, Mateusz Grego and Dariusz Popiela; methodology, Katarzyna Grego; software, Mateusz Baczewski; check, Filip Kwiatkowski, Witold Czyż and Łukasz Stojak; formal analysis, Karina Urbańska; investigation, Mateusz Grego; resources, Dariusz Popiela; data curation, Witold Czyż; writing - rough preparation, Łukasz Stojak; writing - review and editing, Mateusz Baczewski; visualization, Katarzyna Grego; supervision, Filip Kwiatkowski; project administration, Łukasz Stojak; receiving funding, not-applicable.

All authors have read and agreed with the published version of the manuscript.

Funding Statement:
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Institutional Review Board Statement:
Not applicable.

Informed Consent Statement:
Not applicable.

Data Availability Statement:
Not applicable.

Acknowledgments:
Not applicable.

Conflict of interest statement:
Authors have declared no conflict of interests.

References
1. Global report on hypertension the race against a silent killer 2023, World Health Organization. [Internet]. [cited 2023 Sept. 19]. Available from: https://www.who.int/publications/i/item/9789240081062
2. Kaczyńska A, Gaciong Z (2004) Stres psychiczny a nadciśnienie tętnicze Choroby Serca i Naczyń 2004;1(1):73-79. [Internet]. [cited 2004 Nov. 06]. Available from: https://journals.viamedica.pl/choroby_serca_i_naczyn/article/view/12243
3. Schiavone MJ, Richly P, Pronotti V, et al (2022) Use of Benzodiazepines in Hypertension Treatment. Rev Argent Cardiol 90:355–359. https://doi.org/10.7775/rac.v90.i5.20558
4. Salkic S, BaticMujanovic O, Ljuca F, Brkic S (2014) Clinical Presentation of Hypertensive Crises in Emergency Medical Services. Mater Socio Medica 26:12. https://doi.org/10.5455/msm.2014.26.12-16

5. Varounis C, Katsi V, Nihoyannopoulos P, et al (2017) Cardiovascular Hypertensive Crisis: Recent Evidence and Review of the Literature. Front Cardiovasc Med 3:. https://doi.org/10.3389/fcvm.2016.00051
6. Monnet X, Marik PE (2015) What's new with hypertensive crises? Intensive Care Med 41:127–130. https://doi.org/10.1007/s00134-014-3546-7
7. Adebayo O, Rogers RL (2015) Hypertensive Emergencies in the Emergency Department. Emerg Med Clin North Am 33:539–551. https://doi.org/10.1016/j.emc.2015.04.005
8. Peixoto AJ (2019) Acute Severe Hypertension. N Engl J Med 381:1843–1852. https://doi.org/10.1056/NEJMcp1901117
9. Chobanian AV, Bakris GL, Black HR, et al (2003) Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Hypertension 42:1206–1252. https://doi.org/10.1161/01.HYP.0000107251.49515.c2
10. Węgrzyn A, Targoński R, Bellwon J, et al (2004) Treatment of hypertension in emergent and urgent cases Part I. Hypertensive urgencies [Internet]. [cited 2004 Apr. 06]. Available from: https://journals.viamedica.pl/arterial_hypertension/article/view/12708
11. Johnson W, Nguyen M-L, Patel R (2012) Hypertension Crisis in the Emergency Department. Cardiol Clin 30:533–543. https://doi.org/10.1016/j.ccl.2012.07.011
12. Grossman E, Ironi AN, Messerli FH (1998) Comparative Tolerability Profile of Hypertensive Crisis Treatments: Drug Saf 19:99–122. https://doi.org/10.2165/00002018-199819020-00003
13. Whelton PK, Carey RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Hypertension*. 2018;71(6):e13-e115. doi:10.1161/HYP.0000000000000065
14. Williams B, Mancia G, Spiering W, et al. (2018Wytyczne ESC/ESH dotyczące postępowania w nadciśnieniu tętniczym (2018) [Internet]. [cited 2019 Apr. 06]. Available from: https://journals.viamedica.pl/polish_heart_journal/article/download/KP.2019.0018/62418
15. Tykarski A, Filipiak KJ, Rajzer M. Zalecenia ESH 2023 dotyczące postępowania w nadciśnieniu tętniczym Próba komentarza na temat zmian w stosunku do zaleceń ESH/ESC 2018 i różnic w porównaniu z zaleceniami PTNT 2019. *Nadciśnienie Tętnicze W Prakt*. 2023;9(2):45-84.
16. Trajder A. Abramczyk A. (2004) Nitroprusydek sodu - w doraźnym obniżaniu ciśnienia tętniczego. Współczesna analiza leku. Nadciśnienie Tętnicze : kwartalnik Polskiego Towarzystwa Nadciśnienia Tętniczego. 1428-5851. T. 8, nr 3 (2004), s. 185-190
17. Marte, F., Sankar, P., Patel, P., & Cassagnol, M. (2024). Captopril. In StatPearls. StatPearls Publishing.
18. Kaya, A., Tatlisu, M. A., Kaplan Kaya, T., Yildirimturk, O., Gungor, B., Karatas, B., Yazici, S., Keskin, M., Avsar, S., & Murat, A. (2016). Sublingual vs. Oral Captopril in Hypertensive Crisis. The Journal of emergency medicine, 50(1), 108–115. https://doi.org/10.1016/j.jemermed.2015.07.017

19. Karakiliç, E., Büyükcam, F., Kocalar, G., Gedik, S., & Atalar, E. (2012). Same effect of sublingual and oral captopril in hypertensive crisis. *European review for medical and pharmacological sciences*, *16*(12), 1642–1645.
20. Fung H-L (2004) Biochemical Mechanism of Nitroglycerin Action and Tolerance: Is This Old Mystery Solved? Annu Rev Pharmacol Toxicol 44:67–85. https://doi.org/10.1146/annurev.pharmtox.44.101802.121646
21. Surma S., Więcek A, Adamczak M. (2023) Diuretics — a review of the current Renal Disease and Transplantation Forum 2023, vol 16, no. 3, 81-92
22. Dooley M, Goa KL (1998) Urapidil: A Reappraisal of its Use in the Management of Hypertension. Drugs 56:929–955. https://doi.org/10.2165/00003495-199856050-00016
23. Goldstein D.S (2003) CATECHOLAMINES AND STRESS. Endocrine regulations, vol. 37, 69-80
24. Hering D, Narkiewicz K (2013) Sympathetic nervous system and arterial hypertension: new perspectives, new data. Kardiol Pol 71:441–446. https://doi.org/10.5603/KP.2013.0089
25. Thayer JF, Lane RD (2007) The role of vagal function in the risk for cardiovascular disease and mortality. Biol Psychol 74:224–242. https://doi.org/10.1016/j.biopsycho.2005.11.013
26. Liu M-Y, Li N, Li WA, Khan H (2017) Association between psychosocial stress and hypertension: a systematic review and meta-analysis. Neurol Res 39:573–580. https://doi.org/10.1080/01616412.2017.1317904
27. Hamer M, Steptoe A (2012) Cortisol Responses to Mental Stress and Incident Hypertension in Healthy Men and Women. J Clin Endocrinol Metab 97:E29–E34. https://doi.org/10.1210/jc.2011-2132
28. Brzozowski TM, Konturek S, Chabowski A, et al (2016) Fizjologia człowieka: podręcznik dla studentów medycyny, Wyd. 2, dodr. Edra Urban & Partner, Wrocław
29. Esler M, Jennings G, Lambert G, et al (1990) Overflow of catecholamine neurotransmitters to the circulation: source, fate, and functions. Physiol Rev 70:963–985. https://doi.org/10.1152/physrev.1990.70.4.963
30. Rudolph U, Möhler H (2004) Analysis of $GABA_A$ Receptor Function and Dissection of the Pharmacology of Benzodiazepines and General Anesthetics Through Mouse Genetics. Annu Rev Pharmacol Toxicol 44:475–498. https://doi.org/10.1146/annurev.pharmtox.44.101802.121429
31. Sigel E, Steinmann ME (2012) Structure, Function, and Modulation of GABAA Receptors. J Biol Chem 287:40224–40231. https://doi.org/10.1074/jbc.R112.386664
32. Olsen RW, Sieghart W (2009) GABAA receptors: Subtypes provide diversity of function and pharmacology. Neuropharmacology 56:141–148. https://doi.org/10.1016/j.neuropharm.2008.07.045
33. Halonen LM, Sinkkonen ST, Chandra D, et al (2009) Brain regional distribution of GABAA receptors exhibiting atypical GABA agonism: Roles of receptor subunits. Neurochem Int 55:389–396. https://doi.org/10.1016/j.neuint.2009.04.008
34. Treiman DM, Colling C, Ph R, Calabrese VP (1998) A Comparison of Four Treatments for Generalized Convulsive Status Epilepticus. N Engl J Med

35. Krysta K. Bezpieczne i skuteczne stosowanie benzodiazepin w zaburzeniach psychiatrycznych i towarzyszących im innych schorzeniach [Internet]. [cited 2014 Apr. 22]. Available from: https://journals.viamedica.pl/psychiatria/article/view/38032
36. Olkkola KT, Ahonen J (2008) Midazolam and Other Benzodiazepines. In: Schüttler J, Schwilden H (eds) Modern Anesthetics. Springer Berlin Heidelberg, Berlin, Heidelberg, pp 335–360
37. Muzet, A., Johnson, L. C., & Spinweber, C. L. (1982). Benzodiazepine hypnotics increase heart rate during sleep. *Sleep*, *5*(3), 256–261. https://doi.org/10.1093/sleep/5.3.256
38. Howell, S. J., Wanigasekera, V., Young, J. D., Gavaghan, D., Sear, J. W., & Garrard, C. S. (1995). Effects of propofol and thiopentone, and benzodiazepine premedication on heart rate variability measured by spectral analysis. *British journal of anaesthesia*, *74*(2), 168–173. https://doi.org/10.1093/bja/74.2.168
39. Vozoris NT (2014) Do benzodiazepines contribute to respiratory problems? Expert Rev Respir Med 8:661–663. https://doi.org/10.1586/17476348.2014.957186
40. Grossman E, Nadler M, Sharabi Y, et al (2005) Antianxiety Treatment in Patients With Excessive Hypertension. Am J Hypertens 18:1174–1177. https://doi.org/10.1016/j.amjhyper.2005.03.728
41. Lima, S. G., Nascimento, L. S., Santos Filho, C. N., Albuquerque, M.deF., & Victor, E. G. (2005). Hipertensão arterial sistêmica no setor de emergência. O uso de medicamentos sintomáticos como alternativa de tratamento [Systemic hypertension at emergency units. The use of symptomatic drugs as choice for management]. Arquivos brasileiros de cardiologia, 85(2), 115–123. https://doi.org/10.1590/s0066-782x2005001500008
42. Paštrović, F., Okštajner, P. K., Vodanović, M., Raos, D., Jug, J., Lovrić Benčić, M., & Prkačin, I. (2020). The Role of Anxiolytics in Hypertensive Urgency Management. *Psychiatria Danubina*, *32*(Suppl 4), 593–596.