TYPE 2 DIABETES MELLITUS AND SYSTEMIC ARTERIAL HYPERTENSION: ETIOLOGICAL, PATHOGENIC, AND PATHOPHYSIOLOGICAL ASPECTS

DIABETES MELLITUS TIPO 2 E HIPERTENSÃO ARTERIAL SISTÊMICA: ASPECTOS ETIOLÓGICOS, PATOGÊNICOS E FISIOPATOLÓGICOS

DIABETES MELLITUS TIPO 2 E HIPERTENSIÓN ARTERIAL SISTÉMICA: ASPECTOS ETIOLÓGICOS, PATOGÉNICOS Y FISIOPATOLÓGICOS

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ABSTRACT

Non-communicable chronic diseases represent a major challenge to public health due to their high prevalence, impact on morbidity and mortality, and association with modifiable risk factors such as physical inactivity, inadequate diet, smoking, obesity, and alcohol consumption. Among these diseases, systemic arterial hypertension and type 2 diabetes mellitus stand out because of their increasing frequency and direct relationship with cardiovascular, renal, and metabolic complications. Systemic arterial hypertension has a multifactorial etiology involving genetic predisposition, sympathetic hyperactivity, activation of the renin-angiotensin-aldosterone system, and endothelial dysfunction, whereas type 2 diabetes mellitus results from the interaction between insulin resistance, progressive pancreatic beta-cell dysfunction, and chronic low-grade inflammation. The diagnosis and monitoring of these conditions require careful clinical evaluation and specific laboratory tests, such as blood pressure measurement, fasting blood glucose, glycated hemoglobin, and oral glucose tolerance test. Treatment is based on lifestyle modification, the use of antihypertensive and antidiabetic drugs, as well as continuous follow-up in programs such as HIPERDIA. Therefore, an integrated understanding of these disorders is essential for adequate control, prevention of complications, and improvement of patients' quality of life.

Keywords: Non-Communicable Chronic Diseases. Systemic Arterial Hypertension. Type 2 Diabetes Mellitus. Pathophysiology. Diagnosis. Monitoring.

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RESUMO
As doenças crônicas não transmissíveis representam importante desafio para a saúde pública, em razão de sua elevada prevalência, impacto na morbimortalidade e associação com fatores de risco modificáveis, como sedentarismo, alimentação inadequada, tabagismo, obesidade e etilismo. Entre elas, a hipertensão arterial sistêmica e a diabetes mellitus tipo 2 se destacam pela frequência crescente e pela relação direta com complicações cardiovasculares, renais e metabólicas. A hipertensão arterial sistêmica apresenta etiologia multifatorial, envolvendo predisposição genética, hiperatividade simpática, ativação do sistema renina-angiotensina-aldosterona e disfunção endotelial, enquanto a diabetes mellitus tipo 2 resulta da interação entre resistência à insulina, disfunção progressiva das células beta pancreáticas e inflamação crônica de baixo grau. O diagnóstico e o acompanhamento dessas condições exigem avaliação clínica criteriosa e exames laboratoriais específicos, como medida da pressão arterial, glicemia de jejum, hemoglobina glicada e teste oral de tolerância à glicose. O tratamento baseia-se na mudança de estilo de vida, no uso de fármacos anti-hipertensivos e antidiabéticos, além do seguimento contínuo em programas como o HIPERDIA. Assim, a compreensão integrada desses agravos é fundamental para o controle adequado, a prevenção de complicações e a melhoria da qualidade de vida dos pacientes.

Palavras-chave: Doenças Crônicas Não Transmissíveis. Hipertensão Arterial Sistêmica. Diabetes Mellitus Tipo 2. Fisiopatologia. Diagnóstico. Monitoramento.

RESUMEN
Las enfermedades crónicas no transmisibles representan un importante desafío para la salud pública debido a su elevada prevalencia, impacto en la morbimortalidad y asociación con factores de riesgo modificables, como el sedentarismo, la alimentación inadecuada, el tabaquismo, la obesidad y el consumo de alcohol. Entre ellas, la hipertensión arterial sistémica y la diabetes mellitus tipo 2 destacan por su creciente frecuencia y por su relación directa con complicaciones cardiovasculares, renales y metabólicas. La hipertensión arterial sistémica presenta una etiología multifactorial que involucra predisposición genética, hiperactividad simpática, activación del sistema renina-angiotensina-aldosterona y disfunción endotelial, mientras que la diabetes mellitus tipo 2 resulta de la interacción entre la resistencia a la insulina, la disfunción progresiva de las células beta pancreáticas y la inflamación crónica de bajo grado. El diagnóstico y el seguimiento de estas condiciones requieren una evaluación clínica cuidadosa y exámenes de laboratorio específicos, como la medición de la presión arterial, glucemia en ayunas, hemoglobina glucosilada y prueba oral de tolerancia a la glucosa. El tratamiento se basa en cambios en el estilo de vida, el uso de fármacos antihipertensivos y antidiabéticos, además del seguimiento continuo en programas como HIPERDIA. Así, la comprensión integrada de estas enfermedades es fundamental para el control adecuado, la prevención de complicaciones y la mejora de la calidad de vida de los pacientes.

Palabras clave: Enfermedades Crónicas No Transmisibles. Hipertensión Arterial Sistémica. Diabetes Mellitus Tipo 2. Fisiopatología. Diagnóstico. Monitoreo.

1 INTRODUCTION

Chronic Non-Communicable Diseases (NCDs) are currently one of the main challenges for global public health. According to the World Health Organization (WHO, 2024) and the Ministry of Health (BRASIL, 2021), these diseases are responsible for approximately 74% of deaths in Brazil and for more than 70% of deaths globally. This group encompasses conditions of high social, clinical, and economic burden, with emphasis on cardiovascular diseases, neoplasms, chronic respiratory diseases, and diabetes mellitus, which share widely prevalent modifiable risk factors, such as sedentary lifestyle, inadequate diet, smoking, harmful alcohol consumption, and overweight (WHO, 2024).

The National Health Survey (PNS, 2019) showed that more than half of the Brazilian adult population is diagnosed with at least one NCD, which reinforces the magnitude of the problem and its complexity in the national epidemiological scenario (IBGE, 2020). Although important advances have been made in recent decades, such as the expansion of epidemiological surveillance and the implementation of specific public policies, such as the Strategic Action Plan to Combat NCDs 2021-2030, relevant inequalities still persist in access to prevention, timely diagnosis, and continuous treatment. Such inequities affect, more expressively, populations in situations of social vulnerability, compromising the principles of equity, universality, and integrality of the Unified Health System (SUS) (MALTA et al., 2020).

Among NCDs, Cardiovascular Diseases (CVDs) stand out as the main single cause of mortality in Brazil and in the world, in addition to representing an important factor of morbidity and reduction in quality of life. This group includes conditions of great clinical relevance, such as acute myocardial infarction (AMI), cerebrovascular accident (CVA), heart failure (HF), and arrhythmias. Although many of these conditions can be prevented through health promotion strategies and control of risk factors, their incidence remains high (PAHO, 2025).

In this context, systemic arterial hypertension (SAH) is the main risk factor for CVD, being recognized as a true silent pandemic. It is estimated that about one in four Brazilian adults lives with the disease, with a prevalence of 27.9% in the capitals, especially affecting women and individuals with less education. Defined by persistently high blood pressure levels, equal to or greater than 140/90 mmHg, SAH is often asymptomatic, which favors its underreporting and late diagnosis, although it is associated with important cardiovascular, renal, and cognitive complications (BRASIL, 2023; MIGOWSKI; COSTA, 2024).

At the same time, type 2 Diabetes Mellitus (DM2) stands out as one of the most prevalent and worrisome metabolic diseases of contemporary times, with growing projections worldwide. In Brazil, it is estimated that 16.6 million adults live with diabetes, and

approximately 31.9% are unaware of the diagnosis (IDF, 2024). It is a multifactorial condition, associated with aging, obesity, sedentary lifestyle, and inadequate eating habits, with a high potential to cause micro and macrovascular complications, such as retinopathy, nephropathy, neuropathy, amputations, and major cardiovascular events (IDF, 2021; WHO, 2023).

It is also noteworthy that most of the complications associated with SAH and DM2 can be prevented or minimized through early diagnosis, longitudinal follow-up, and therapeutic adherence. However, because these are diseases of insidious and often silent course, late diagnoses and interventions performed in advanced stages are frequent. This scenario reinforces the need for effective strategies for tracking, risk stratification, and continuous monitoring, especially in the context of Primary Health Care (PHC), the main gateway to the SUS and a strategic level for care coordination (IDF, 2021; WHO, 2023).

Thus, the objective of this chapter is to describe the main etiological, pathogenic, and pathophysiological aspects of type 2 diabetes mellitus and systemic arterial hypertension, highlighting their relevance as chronic non-communicable diseases, their risk factors, the pathophysiological mechanisms involved, and the possibilities of treatment, with emphasis on multidisciplinary action and health care programs.

2 CHRONIC NON-COMMUNICABLE DISEASES - NCDs

Chronic Non-Communicable Diseases (NCDs) are a set of clinical conditions of a prolonged nature, which are not caused by infectious agents and, therefore, do not present a risk of transmission between individuals. Such diseases result from the complex interaction of genetic, physiological, environmental, and behavioral factors, and are characterized by a generally silent onset, slow evolution, and often an asymptomatic course in the early stages (WHO, 2024).

NCDs mainly encompass cardiovascular diseases (such as acute myocardial infarction and stroke), various types of cancer, chronic respiratory diseases (including chronic obstructive pulmonary disease - COPD and asthma) and diabetes mellitus. These four groups of diseases together represent the greatest burden of morbidity and mortality in the global public health scenario, not only because of their high prevalence, but also because of the economic and social impacts associated with their management and the productive losses they cause (MIGOWSKI; COSTA, 2024; WHO, 2024).

Although they can affect individuals at any stage of life, the incidence and prevalence of NCDs increase significantly with population aging, which makes them especially frequent among adults and the elderly. According to estimates by the World Health Organization

(WHO), approximately 18 million deaths attributed to NCDs occur before the age of 70, surpassing all other combined causes of death in this age group. Of this total, about 82% are registered in low- and middle-income countries, which highlights the deep inequality in the distribution of risk and access to health care (STOPA et al., 2022; BRAZIL, 2021; WHO, 2024).

Data from the WHO (2021) indicate that approximately 75% of deaths unrelated to the COVID-19 pandemic, on a global scale, were caused by NCDs. In this context, cardiovascular diseases remain the leading cause of death, with more than 19 million deaths recorded in 2021, followed by cancers (10 million), chronic respiratory diseases (4 million), and diabetes (more than 2 million, including cases resulting from renal complications). Together, these four categories account for approximately 80% of all premature deaths attributed to NCDs (MALTA et al. 2014; WHO, 2024).

In Brazil, the *Epidemiological Bulletin of Premature Mortality (30 – 69 years) due to Chronic Non-Communicable Diseases in Rio Grande do Sul* (2024) reveals the persistence of the impact of these diseases on the population. In 2013, 20,855 premature deaths were recorded attributed to the four main NCDs, of which 12,133 (58.2%) occurred among men and 8,722 (41.8%) among women. In 2023, the total number of premature deaths was 20,410, of which 11,466 (56.2%) were males and 8,940 (43.8%) were females. Among the diseases studied, cancer remained the main cause of premature mortality in both sexes, followed by cardiovascular diseases (RIO GRANDE DO SUL, 2024).

A particularly alarming fact refers to the proportional growth in deaths from diabetes mellitus (DM), which increased from 7.1% to 9.4% between 2013 and 2023, which represents an increase of approximately 32.2% in the absolute number of deaths. This trend was observed both in males, with an increase of 41.5%, and in females, with an increase of 21.1%, which indicates a significant increase in the burden of the disease in the state's population. On the other hand, cardiovascular diseases showed a reduction in the proportional participation of premature deaths, although they remain the second leading cause of early mortality (RIO GRANDE DO SUL, 2024).

Most of the risk factors associated with NCDs are preventable and are directly related to the population's lifestyle. Among the main behavioral determinants are inadequate eating habits, sedentary lifestyle, use of tobacco products, abusive consumption of alcoholic beverages and exposure to environmental pollution. Such factors contribute to significant metabolic alterations, such as increased blood pressure, elevated blood glucose, dyslipidemia, and overweight, characterizing the so-called metabolic risk factors. These, in turn, are strongly associated with the development of NCDs, especially cardiovascular

diseases, which lead the global indicators of avoidable mortality (BRASIL, 2021; WHO, 2024; VIGITEL, 2023).

Among the NCDs with the highest prevalence and impact, systemic arterial hypertension (SAH) stands out, considered one of the main modifiable risk factors for cardiovascular, cerebrovascular, and renal events. It is estimated that more than 1.28 billion adults between 30 and 79 years of age live with hypertension in the world, and two-thirds of them live in low- and middle-income countries. Also according to the WHO, 46% of people with hypertension are unaware of the diagnosis, only 42% receive treatment, and only 21% have the condition under adequate control (MALTA et al., 2022; WHO, 2023).

SAH represents a relevant public health problem. Data from the Surveillance of Risk and Protective Factors for Chronic Diseases by Telephone Survey (VIGITEL), referring to the year 2023, point to a self-reported prevalence of SAH of 27.6% among Brazilian adults. This prevalence increases progressively with age, being higher among women, individuals with a lower level of education, and residents of the Southeast and South regions of the country (BRASIL, 2021; VIGITEL, 2023).

Diabetes mellitus is one of the most relevant public health challenges in Brazil, which currently occupies the sixth position among the countries with the highest absolute number of cases of the disease worldwide. According to data from the Brazilian Diabetes Society (SBD), approximately 16.6 million Brazilians between 20 and 79 years old live with the disease. The self-reported prevalence of diabetes among adults is 11.1% in women and 9.1% in men, with an increase proportional to age and lower schooling. In addition, about 32% of cases remain undiagnosed, which aggravates the complications associated with the disease. Mortality attributed to diabetes more than doubled between 1992 and 2019, from 12.8 to 30.2 deaths per 100 thousand inhabitants, and its economic burden is significant, especially in the Unified Health System (SUS), where a large part of hospital costs is related to cardiovascular complications. The growing prevalence and the financial and social impact reinforce the urgency of public policies that integrate prevention, early diagnosis, and effective treatment (SBD, 2024; MALTA et al., 2022).

In Nova Candelária (RS), a municipality located in the northwest region of the state, chronic non-communicable diseases (NCDs) continue to be important causes of morbidity and mortality. According to DATASUS data for the year 2024, the mortality coefficient due to NCDs was 193.42 per 100 thousand people and the hospital admission rate was 1,611.86 per 100 thousand people, evidencing the impact of these diseases on the health of the local population. Diseases of the circulatory system and diabetes had the same mortality coefficient, which was 64.47/100 thousand people. Also in 2024, the rate of hospitalization

for diseases of the circulatory system reached 967.12 per 100 thousand inhabitants, and the rate of hospitalizations related to diabetes was 128.95 per 100 thousand inhabitants, indicating the need to intensify preventive actions and clinical management in primary health care (BRASIL, 2025).

2.1 SYSTEMIC ARTERIAL HYPERTENSION - SAH

2.1.1 Etiology

Systemic Arterial Hypertension (SAH) is a multifactorial clinical condition, whose etiology results from a complex interaction between genetic, environmental, and behavioral factors. The most prevalent form, accounting for 90% to 95% of cases, is classified as primary or essential hypertension and is characterized by the absence of a single identifiable cause. Evidence points to a significant familial predisposition, since individuals with a family history of the disease are at increased risk for its development. Such predisposition is associated with genetic polymorphisms that influence the regulation of the renin-angiotensin-aldosterone system (RAAS), the control of vascular tone, and sodium metabolism (CAREY et al., 2022; PADMANABHAN; DOMINICZAK, 2021).

In addition to genetic determinants, environmental and behavioral factors play a crucial role in the onset and progression of hypertension. Among the main ones are excessive sodium intake, obesity, sedentary lifestyle, alcohol abuse, smoking, chronic stress and inadequate eating patterns. Advanced age is also considered a relevant risk factor, since the aging process compromises arterial compliance, favoring the progressive elevation of blood pressure (AMORIM et al., 2024; COSTA et al., 2018).

Inadequate lifestyle habits are among the main preventable factors associated with high blood pressure. Among them, excessive sodium consumption, which can lead to sodium and water retention, increased plasma volume and, consequently, increased blood pressure. The World Health Organization recommends that the daily consumption of sodium should not exceed 2000mg, which is equivalent to 5g of sodium chloride/day (PAHO, 2023). In this sense, DASH *(Dietary Approaches to Stop Hypertension)* diets have shown important results in reducing blood pressure levels (BARROS et al., 2024).

Obesity/overweight also represents one of the modifiable risk factors for the development of hypertension. In this context, anthropometric parameters are important for clinical evaluation and patient monitoring. Waist circumference (WC) measurement provides independent and additive information to the body mass index (BMI) to predict morbidity and risk of death, so this simple measurement should be considered an important "vital sign" in clinical practice (BARROSO et al., 2020). It should be noted that overweight/obesity are

associated with increased peripheral vascular resistance, cardiac output overload, and endothelial dysfunction, mechanisms that, together, favor the increase in blood pressure levels (AMORIM et al., 2024; BARROSO et al., 2020; MALTA et al., 2022).

Another preventable cause is a sedentary lifestyle, which contributes to weight gain, insulin resistance, and endothelial dysfunction, in addition to negatively impacting blood pressure regulation, while the regular practice of physical activity exerts a protective effect, helping to reduce blood pressure. In addition, habits such as alcohol abuse and smoking are strongly related to hypertension. Alcohol, when ingested in large quantities, can raise blood pressure levels, while smoking induces vasoconstriction and damage to the vascular endothelium (AMORIM et al., 2024). In addition, chronic stress also contributes to the increase in blood pressure since this state stimulates the continuous release of hormones such as adrenaline and cortisol, capable of causing transient increases in blood pressure and, in the long term, contributing to the onset of hypertension (OLIVEIRA et al., 2021).

National studies, such as Vigitel (2023), indicate that a large part of the population has two or more combined risk factors, which combined and with synergistic action intensify the risk of early development of SAH. The prevention, control, treatment, and monitoring of hypertension are associated with lifestyle interventions, with a proven impact on the incidence and severity of the disease (BRASIL, 2023; MALTA et al., 2022)

In contrast to the primary form, secondary hypertension has a defined etiology and corresponds to a smaller portion of cases. Its causes are potentially treatable and include nephropathies, endocrine disorders (such as primary hyperaldosteronism and pheochromocytoma), long-term use of certain drugs (such as corticosteroids and oral contraceptives), and obstructive sleep apnea (CAREY et al., 2022; PADMANABHAN; DOMINICZAK, 2021).

2.1.2 Pathogenesis

Systemic arterial hypertension (SAH) is a chronic clinical condition characterized by persistent elevation of blood pressure levels, resulting from a set of functional and structural alterations that compromise, in an integrated manner, the cardiovascular, renal and neurohormonal systems. Its pathogenesis is complex and multifactorial, involving interrelated pathophysiological mechanisms that contribute to the sustained increase in blood pressure. Among the main ones, the exacerbated activation of the renin-angiotensin-aldosterone system (RAAS), increased activity of the sympathetic nervous system, endothelial dysfunction, and renal sodium and water retention stand out. These changes converge to the promotion of peripheral vasoconstriction, increased systemic vascular

resistance, and increased intravascular volume, creating a favorable scenario for chronic hypertension maintenance and progressive vascular remodeling (AMORIM et al., 2024; ALBUQUERQUE, 2024).

From a clinical point of view, SAH has an insidious evolution and is often asymptomatic in its early stages, which hinders early diagnosis and favors underreporting of cases. In most situations, detection occurs incidentally, during routine medical consultations. When present, the most frequently reported signs and symptoms include headache, dizziness, palpitations, tinnitus, visual blurring, dyspnea, and chest pain, especially in situations of hypertensive crisis or when there is target organ impairment (BARROSO et al., 2021; AMORIM et al., 2024; ALBUQUERQUE, 2024).

Hypertension-related headache, often called "hypertensive headache", tends to occur predominantly in the occipital region and is generally described as pulsatile, with variable intensity. It can intensify in the face of acute elevations in blood pressure, particularly in hypertensive crises. However, it should be noted that such a manifestation is not pathognomonic of SAH, as it can be associated with several other clinical conditions, which requires careful diagnostic investigation (SMITH et al., 2023).

In the cardiovascular context, left ventricular hypertrophy (LVH) is one of the main morphofunctional repercussions of chronic hypertension. This process results from the sustained increase in the hemodynamic overload imposed on the heart, leading to thickening of the ventricular wall and changes in its filling and ejection capacity. Echocardiography is the method of choice for detecting LVH, allowing the evaluation of the magnitude of cardiac structural and functional changes. The presence of this condition is strongly associated with an increased risk of adverse events, such as heart failure, arrhythmias, and stroke, and is therefore recognized as a marker of target organ damage and indicative of the need for more rigorous therapeutic intervention (ALBUQUERQUE, 2024).

Maintenance of SAH without adequate control triggers a continuous process of injury to multiple target organs. In the cardiovascular system, it favors the development of myocardial ischemia (angina pectoris), acute myocardial infarction, and ventricular dysfunction, which can culminate in congestive heart failure. In the renal system, persistently elevated blood pressure promotes glomerular sclerosis and arteriolar nephrosclerosis, resulting in progressive loss of renal function and possible progression to chronic kidney disease. In the ophthalmological field, hypertension can cause significant changes in the retinal microcirculation, characterizing hypertensive retinopathy, whose evolution can lead to partial or total loss of vision. In addition, SAH is one of the most relevant modifiable risk

factors for stroke, whether in the ischemic or hemorrhagic form (ALBUQUERQUE, 2024; AMORIM et al., 2024).

2.1.3 Pathophysiology

The pathophysiology of Systemic Arterial Hypertension (SAH) is characterized by a complex and interdependent set of functional and structural alterations that mainly involve the cardiovascular, renal, sympathetic nervous and endocrine systems. Among the vascular mechanisms, endothelial dysfunction stands out as one of the central factors in the genesis and progression of the disease. The endothelium, consisting of a single layer of cells that lines the blood vessels internally, plays a fundamental role in the regulation of vascular tone through the balanced release of vasodilator substances, such as nitric oxide (NO), and vasoconstrictors, such as endothelin-1. In hypertensive individuals, there is a reduction in the bioavailability of NO and a relative increase in vasoconstrictor mediators, resulting in an increase in peripheral vascular resistance. Such an imbalance favors the reduction of arterial compliance and vascular remodeling, with progressive loss of elasticity of the vessels, culminating in a sustained increase in blood pressure (ALBUQUERQUE, 2024; BRYAN, 2022).

Another relevant mechanism is the exacerbated activation of the renin-angiotensin-aldosterone system (RAAS). Angiotensin II, the main effector of this system, has a potent vasoconstrictor action, intensifies the activity of the sympathetic nervous system, stimulates the secretion of aldosterone, and induces renal sodium and water retention. These combined actions increase intravascular volume and systemic vascular resistance, in addition to promoting vascular inflammation and endothelial injury. Evidence also indicates that angiotensin II acts on macrophages, stimulating cholesterol synthesis and contributing to the formation of atherosclerotic plaques, which reinforces its role in both the development of SAH and its cardiovascular complications (SU et al., 2021; ALBUQUERQUE, 2024).

Renal function plays a determining role in pressure homeostasis, regulating extracellular volume and fluid and electrolyte balance. Excessive sodium and water retention, often mediated by aldosterone, raises blood volume and, consequently, blood pressure. On the other hand, chronic hypertension can induce progressive damage to nephrons, establishing a pathological cycle in which kidney injury aggravates the hypertensive condition and this, in turn, accelerates the deterioration of renal function (REZENDE et al., 2021; YE et al., 2022; SANTOS et al., 2024).

In addition, sympathetic nervous system hyperactivity and chronic inflammatory status play significant roles in the maintenance of hypertension. Exacerbated sympathetic

stimulation causes tachycardia, peripheral vasoconstriction, and increased catecholamine release, increasing hemodynamic overload on the heart and vessels. Chronic inflammation, on the other hand, favors endothelial dysfunction, oxidative stress, and structural remodeling of the myocardium and vasculature, contributing to the hypertensive phenotype and increased risk of cardiovascular complications in the long term (LOPES et al., 2021). An integrated understanding of these pathophysiological mechanisms is essential to support more comprehensive therapeutic interventions, as well as to identify biomarkers that aim to predict the occurrence of cardiovascular events or complications resulting from major hypertension and reduce mortality associated with hypertension (YE et al., 2022).

2.1.4 Diagnostics and monitoring

The diagnosis of Systemic Arterial Hypertension (SAH) is based on the repeated and standardized measurement of blood pressure, associated with a comprehensive clinical evaluation and, when indicated, complementary tests. According to the current guidelines, the measurement should be performed with a calibrated sphygmomanometer, following strict technical criteria: the patient should remain at rest for at least five minutes, sitting, with legs uncrossed, feet flat on the floor, back relaxed and supported, arm positioned at heart level, without having ingested caffeine, smoked or practiced intense physical exercise in the previous 30 minutes (BRANDÃO et al., 2025; BARROSO et al., 2021; WHELTON et al., 2024).

The diagnosis is established when the pressure levels are equal to or greater than 140 mmHg for systolic pressure and/or 90 mmHg for diastolic pressure, measured on at least two different occasions, with the patient in ideal conditions. The classification of SAH, according to the stage of pressure elevation, is essential to define the severity of the condition and guide therapeutic management. Table 1 shows the BP classification (BRANDÃO et al., 2025; BARROSO et al., 2021; SMITH et al., 2023).

Figure 1

Classification of blood pressure according to the measurement in the office from 18 years of age

Classificação da PA	PAS (mmHg)		PAD (mmHg)
PA normal	< 120	e	< 80
Pré-hipertensão	120–139	e/ou	80–89
HA Estágio 1	140–159	e/ou	90–99
HA Estágio 2	160–179	e/ou	100–109
HA Estágio 3	≥ 180	e/ou	≥ 110

DBHA: Diretriz Brasileira de Hipertensão Arterial; HA: hipertensão arterial; PA: pressão arterial; PAD: pressão arterial diastólica; PAS: pressão arterial sistólica.

[a]A classificação é definida de acordo com a PA no consultório e pelo nível mais elevado de PA, sistólica ou diastólica.

[b]A HA sistólica isolada, caracterizada pela PAS ≥ 140 mmHg e PAD < 90 mmHg, é classificada em Estágio 1, 2 ou 3, de acordo com os valores da PAS nos intervalos indicados.

[c]A HA diastólica isolada, caracterizada pela PAS < 140 mmHg e PAD ≥ 90 mmHg, é classificada em Estágio 1, 2 ou 3, de acordo com os valores da PAD nos intervalos indicados.

Source: Adapted from BRANDÃO et al. (2025).

Ambulatory Blood Pressure Monitoring (ABPM) and Home Blood Pressure Monitoring (HBPM) represent important tools to confirm the diagnosis and identify specific conditions. ABPM records blood pressure values, in an automated way, for 24 hours, allowing the analysis of the circadian profile of blood pressure and the evaluation of prognostic parameters, such as nocturnal blood pressure. HBPM, on the other hand, consists of serial measurement performed by the patient in a home environment, usually for five to seven days, with morning and afternoon measurements under controlled conditions. These methods are essential to detect white-coat hypertension, blood pressure elevation restricted to the clinical environment, and masked hypertension, normal values in the office, but elevated in other situations, preventing diagnostic errors (BRANDÃO et al., 2025; AMORIM et al., 2024; BARROSO et al., 2021).

In addition to blood pressure measurement, the diagnostic evaluation should include detailed anamnesis, complete physical examination, and laboratory and imaging tests. The anamnesis should address cardiovascular risk factors, family history, lifestyle habits (diet, alcohol consumption, smoking, physical activity), use of drugs and presence of comorbidities, such as diabetes mellitus, dyslipidemia and chronic kidney disease. The physical examination should include cardiac and pulmonary auscultation, palpation of peripheral pulses, measurement of weight, height, calculation of body mass index (BMI), measurement of abdominal circumference (WC) and search for signs of target organ

damage or secondary causes of hypertension (BRANDÃO et al., 2025; BARROSO et al., 2021; ALBUQUERQUE, 2024).

The complementary tests aim to confirm the diagnosis, stratify cardiovascular risk and identify subclinical lesions. Fasting blood glucose, lipid profile, serum creatinine, potassium, uric acid, and type I urine test are recommended, in addition to imaging tests, such as electrocardiogram and echocardiogram, useful for the early detection of structural changes, such as left ventricular hypertrophy (BRANDÃO et al., 2025; BARROSO et al., 2021; LEE et al., 2022; WHELTON et al., 2024).

Monitoring SAH, in addition to aiding in diagnosis, is crucial for clinical follow-up and assessment of response to treatment. ABPM and HBPM allow the therapeutic regimen to be adjusted more precisely, to verify the patient's adherence to pharmacological and non-pharmacological measures, and to identify relevant pressure variations. The systematic use of these resources, combined with organized records, favors communication between the patient and the health team, optimizes decision-making, and contributes to the prevention of cardiovascular events (BRANDÃO et al., 2025; BARROSO et al., 2020; ALBUQUERQUE, 2024).

2.1.5 Treatment

The treatment of Systemic Arterial Hypertension (SAH) has as its main objective to reduce and maintain blood pressure levels within parameters considered normal, preventing or delaying the development of target organ damage and significantly reducing the risk of cardiovascular and cerebrovascular events. This therapeutic approach, in addition to reducing the morbidity and mortality associated with the disease, aims to improve the quality of life and life expectancy of patients (BRANDÃO et al., 2025; WHELTON et al., 2024; AMORIM et al., 2024).

Treatment should be based on integrated strategies, combining non-pharmacological and pharmacological measures, whose choice and intensity are determined by the clinical profile, presence of comorbidities, and overall cardiovascular risk. In this context, non-pharmacological measures represent the initial pillar of SAH management and include: smoking cessation; adoption of a healthy dietary pattern, such as the DASH (Dietary Approaches to Stop Hypertension) diet, characterized by high consumption of fruits, vegetables, legumes and low-fat dairy products, associated with a reduction in the intake of sodium and saturated fats; body weight control, with a Body Mass Index (BMI) target between 18.5 and 24.9 kg/m²; moderation of the consumption of alcoholic beverages; regular practice of aerobic physical activity and muscle strengthening; slow breathing techniques

and stress management strategies. Early implementation of these interventions is capable, in many cases, of promoting significant reductions in blood pressure and delaying the need for pharmacological treatment (BRANDÃO et al., 2025; BARROSO et al., 2021).

Pharmacological treatment, on the other hand, is indicated when non-pharmacological measures alone are not sufficient to achieve blood pressure goals or, immediately, in patients with stage 2 hypertension or with high cardiovascular risk. The main classes of antihypertensives, thiazide diuretics (IUDs), calcium channel blockers (CCBs), angiotensin-converting enzyme inhibitors (ACEIs), angiotensin II receptor blockers (ARBs) and beta-blockers (BBs) have demonstrated proven efficacy in reducing blood pressure levels and preventing cardiovascular complications (BRANDÃO et al., 2025; BARROSO et al., 2021; WHELTON et al., 2024). Treatment can be initiated by monotherapy or, preferably, by combination therapy, especially in patients with higher blood pressure values or a higher risk of events. The choice of drug should be individualized, considering pharmacokinetic and pharmacodynamic characteristics, the presence of associated diseases, target organ damage (LOA), and socioeconomic conditions (BRANDÃO et al., 2025; BARROSO et al., 2021).

The clinical management of SAH requires regular follow-up and continuous monitoring, with periodic clinical and laboratory evaluations. In addition to frequent blood pressure measurement, it is essential to control renal function, serum levels of electrolytes, and other biomarkers, allowing early identification of adverse effects and the adequacy of therapy. Patient education plays a crucial role in the process, promoting treatment adherence and the reduction of modifiable risk factors (BRANDÃO et al., 2025; RASMUSSEN et al., 2020; WHELTON et al., 2024).

When properly conducted, the treatment of SAH is able to prevent serious complications, such as acute myocardial infarction, stroke, and chronic renal failure, in addition to contributing to the maintenance of functionality and the improvement of quality of life (BRANDÃO et al., 2025; RASMUSSEN et al., 2020; BARROSO et al., 2021; WHELTON et al., 2024).

2.2 TYPE 2 DIABETES MELLITUS

2.2.1 Etiology

Diabetes Mellitus (DM) is a chronic metabolic syndrome of multifactorial etiology, resulting from the interaction between genetic predisposition, environmental and behavioral factors. The disease has different subtypes, among which type 1 Diabetes Mellitus (DM1) is characterized by the autoimmune destruction of β-pancreatic cells, usually in genetically

predisposed individuals, culminating in absolute insulin deficiency and persistent hyperglycemia. On the other hand, type 2 Diabetes Mellitus (DM2) accounts for more than 90% of cases diagnosed globally and has a complex pathophysiology, marked by ineffective insulin secretion by β cells and resistance of peripheral tissues to its action (ADA, 2024; SBD, 2024; OJO et al., 2023).

T2DM arises from disturbances in the production and utilization of insulin, resulting in persistently high plasma glucose levels. Among the most relevant risk factors, the following stand out: overweight and obesity, chronic hyperglycemia, dyslipidemia, inadequate eating habits, sedentary lifestyle, aging, family history of the disease, as well as psychosocial conditions such as stress, anxiety, and depression (IDF, 2024; COUTO et al., 2024).

Visceral obesity is one of the main determinants of DM2, since the excessive deposition of abdominal fat favors insulin resistance through the release of pro-inflammatory adipokines, compromising peripheral glucose uptake and amplifying the risk of the disease (COUTO et al., 2024). At the same time, physical inactivity increases the prevalence of insulin resistance, while the regular practice of physical exercise plays a protective role, promoting the reduction of abdominal fat, improved glucose tolerance, glycemic control, reduction of oxidative stress, and modulation of inflammatory processes (OLIVEIRA et al., 2023).

In addition, several associated medical conditions, such as systemic arterial hypertension and dyslipidemias, contribute to the pathophysiology of DM2. These comorbidities intensify insulin resistance and significantly increase the risk of cardiovascular complications, such as acute myocardial infarction and stroke (BROWN et al., 2023; IZAR et al., 2021).

Smoking is another aggravating factor, related to an approximately 60% increase in the risk of developing DM2 in smokers of more than 20 cigarettes/day. Nicotine directly affects glucose metabolism, favoring insulin resistance by mechanisms of oxidative stress, systemic inflammation, endothelial dysfunction, and changes in lipid metabolism. In addition, chronic exposure compromises β-pancreatic function, reducing insulin secretion (YANG et al., 2022; OLIVEIRA et al., 2023).

Similarly, excessive alcohol consumption (above 60 g/day) is related to insulin resistance and increased risk of T2DM, promoting hepatic triglyceride accumulation, greater production of reactive oxygen species, and chronic low-grade inflammation (SALAMA et al., 2021).

Finally, aging is highlighted as a non-modifiable and highly relevant factor in the incidence of DM2, as it promotes a physiological increase in insulin resistance, a reduction

in the mass and function of β cells, and a greater predisposition to metabolic complications, especially in elderly populations (ADA, 2024; OLIVEIRA et al., 2023).

2.2.2 Pathogenesis and Clinical Manifestations

The development of type 2 diabetes mellitus (T2DM) is characterized by a complex interaction between peripheral insulin resistance and progressive pancreatic beta cell dysfunction. Insulin resistance initially manifests itself in target tissues, skeletal muscle, liver, and adipose tissue, reducing insulin's ability to promote glucose uptake and utilization. As a compensatory mechanism, beta cells increase insulin secretion; however, over time, functional exhaustion occurs, culminating in a relative deficiency of this hormone (DEFRONZO et al., 2021; ADA, 2023).

Insulin resistance in the liver is responsible for increasing endogenous glucose production, contributing to fasting hyperglycemia, while in skeletal muscle it compromises postprandial glucose uptake, resulting in postprandial hyperglycemia. In addition, adipose tissue has greater lipolysis, promoting excessive release of free fatty acids into the circulation, which interfere with insulin signaling and favor lipotoxicity (DEFRONZO et al., 2021; ADA, 2023;).

Chronic low-grade inflammation and oxidative stress also play a relevant role in the pathogenesis of T2DM. Evidence indicates that pro-inflammatory adipokines, such as TNF-α and IL-6, associated with endothelial dysfunction and increased production of reactive oxygen species, aggravate insulin resistance, establishing a negative feedback loop. The clinical manifestations of DM2 vary according to the stage of the disease and the presence of associated complications. Many patients remain asymptomatic for years, being diagnosed only in routine exams or after the appearance of micro or macrovascular complications (ADA, 2023).

Classic symptoms include polydipsia, polyuria, polyphagia, and unexplained weight loss, which usually become evident only in later stages. Nonspecific symptoms, such as fatigue, blurred vision, recurrent skin infections, and delayed wound healing, may also be present (SDB, 2024).

In addition, chronic complications represent relevant manifestations. Among the microvascular diseases, diabetic retinopathy, nephropathy and peripheral neuropathy stand out. Macrovascular diseases include coronary artery disease, stroke, and peripheral artery disease. These complications are the main cause of morbidity and mortality among individuals with T2DM, highlighting the importance of early diagnosis and appropriate treatment (ADA, 2023).

2.2.3 Pathophysiology

Type 2 diabetes mellitus (DM2) is a complex and multifactorial metabolic disease, whose pathophysiology involves the dynamic interaction between peripheral insulin resistance, progressive β-pancreatic cell dysfunction, and inflammatory and metabolic factors associated with visceral obesity. The end result is the onset of chronic hyperglycemia and the maintenance of a metabolic environment that favors the development of micro and macrovascular complications (GALICIA-GARCIA et al., 2020; OLIVEIRA et al., 2023).

In the early stages of DM2, peripheral tissues, especially skeletal muscle, liver, and adipose tissue, show reduced response to insulin action. This phenomenon compromises glucose uptake by the muscle, increases hepatic glucose production by gluconeogenesis and glycogenolysis, and intensifies lipolysis in adipose tissue. The increased release of free fatty acids into the circulation exerts a lipotoxic effect on different tissues, contributing to the amplification of insulin resistance and, simultaneously, to the elevation of glycemic levels (GALICIA-GARCIA et al., 2020; OLIVEIRA et al., 2023).

To compensate for peripheral resistance, β cells in pancreatic islets increase insulin secretion, leading to a state of compensatory hyperinsulinemia. However, with the advancement of the disease, progressive failure of these cells is observed, characterized by a reduction in pancreatic cell mass, stress of the endoplasmic reticulum, and accumulation of amyloid deposits, which culminate in insufficient insulin secretion. This process represents one of the important milestones in the transition from glucose intolerance to the establishment of DM2 (GALICIA-GARCIA et al., 2020; COUTO et al., 2024).

In addition, excess visceral adipose tissue plays a central role in the pathophysiology of DM2 by behaving as an active endocrine organ. This tissue secretes pro-inflammatory adipokines, such as tumor necrosis factor alpha (TNF-α) and interleukin-6 (IL-6), which contribute to the establishment of a chronic low-grade inflammatory state. Inflammation, associated with oxidative stress triggered by hyperglycemia and lipotoxicity, compromises insulin sensitivity and accentuates pancreatic dysfunction, creating a pathological feedback loop (OLIVEIRA et al., 2023; COUTO et al., 2024).

In addition, dysfunctions in the gut-pancreas axis play a relevant role in DM2, mainly due to the reduction in the action of incretins, such as glucagon-like peptide type 1 (GLP-1) and glucose-dependent insulinotropic polypeptide (GIP). These molecules, normally responsible for stimulating postprandial insulin secretion, have a diminished effect in individuals with T2DM, limiting the ability of the pancreas to respond appropriately to glycemic variations after dietary intake (GALICIA-GARCIA et al., 2020).

The interaction between insulin resistance, progressive β cell dysfunction, chronic inflammation, oxidative stress, and reduced incretins effect establishes a vicious cycle. These factors feed back on each other, perpetuating hyperglycemia and accelerating both the progression of the disease and the emergence of its chronic complications, such as nephropathy, retinopathy, neuropathy, and cardiovascular diseases (GALICIA-GARCIA et al., 2020; OLIVEIRA et al., 2023; COUTO et al., 2024).

2.2.4 Diagnosis and Monitoring

The diagnosis of diabetes mellitus (DM) is based on the detection of persistent hyperglycemia by means of standardized laboratory parameters. The Brazilian Diabetes Society (SBD) recommends the use of fasting plasma glucose (FPG), oral glucose tolerance test (OGTT/OTT) and glycated hemoglobin (HbA1c) for diagnostic confirmation. The OGTT consists of measuring blood glucose after one hour (OGTT-1h) or two hours (OGTT-2h) of oral administration of 75 g of glucose (RODACKI et al., 2024).

Laboratory tests should be performed in all individuals with signs or symptoms suggestive of DM, as well as in asymptomatic individuals at increased risk for the disease. The diagnostic criteria are: fasting glucose ≥ 126 mg/dL, HbA1c ≥ 6.5%, glucose at OGTT-1h ≥ 209 mg/dL, or glucose at OGTT-2h ≥ 200 mg/dL. If only one of the tests is altered, it should be repeated for confirmation (RODACKI et al., 2024).

During the diagnostic work-up, individuals with mild glycemic alterations who do not meet the criteria for DM may be identified. The *International Diabetes Federation* (IDF) calls this condition intermediate hyperglycemia, which manifests as altered fasting glucose or glucose intolerance after OGTT. The *American Diabetes Association* (ADA) and the SBD, on the other hand, use the term prediabetes, widely accepted in clinical practice due to its clarity in communication, although not all individuals progress to DM (RODACKI et al., 2024).

The OGTT-1h has been increasingly recommended both for the diagnosis of T2DM and for the detection of prediabetes, due to its greater practicality and sensitivity compared to the OGTT-2h. Blood glucose values ≥ 209 mg/dL confirm T2DM, while levels ≥ 155 mg/dL indicate prediabetes. T2D screening is recommended for all individuals aged 35 years and older, as well as for adults who are overweight or obese and have at least one additional risk factor or high or very high FINDRISC (Finnish Diabetes Risk Questionnaire) (RODACKI et al., 2024).

Fasting glucose and/or HbA1c should be considered the first screening tests, and the choice is up to the local availability of HbA1c measurement. In adults already classified as prediabetic by FPG and HbA1c, additional performance of the OGTT-1h is recommended to

identify undiagnosed cases of T2DM (≥ 209 mg/dL) or for future risk stratification (155 - 208 mg/dL) (RODACKI et al., 2024).

At initial screening, if FPG is < 100 mg/dL and HbA1c < 5.7%, in individuals with fewer than three risk factors and low or moderate FINDRISC, there is no need for additional testing. However, in individuals with three or more risk factors or high/very high FINDRISC, it is recommended to perform the OGTT-1h to complement the investigation (RODACKI et al., 2024). After the initial screening for T2DM, it is recommended that a frequency of repeat screening be followed according to the clinical situation presented in the initial investigation, as shown in the table below.

Table 1

Frequency of repeat T2DM screening according to the clinical situation presented in the initial investigation

Clinical Situation	**T2D screening frequency**
People without symptoms and with only one test meeting criteria for DM	Semester
People with confirmed prediabetes	Annual
People with normal tests and ≥ 3 risk factors	Annual
People with normal tests and high/very high FINDRISC	Annual
People with normal tests and < 3 risk factors	Triennial
People with normal tests and low/moderate FINDRISC	Triennial

Source: Adapted from Rodacki, 2024.

In addition, individuals with comorbidities associated with secondary diabetes (such as endocrinopathies, pancreatic diseases, HIV infection, or metabolic steatotic liver disease - DHEM) should be screened for DM. The SBD recommends screening for EMHD in all patients with T2DM, given the bidirectional relationship between the conditions: EMHD increases the risk of T2DM, and this accelerates the progression of EMHD to more severe forms, such as steatohepatitis, fibrosis, cirrhosis, and hepatocarcinoma (RODACKI et al., 2024). DM screening is also indicated in patients who will start drugs with hyperglycemic potential, such as glucocorticoids and antipsychotics, both before and after the start of treatment. In the case of children and adolescents, it is recommended to start screening from the age of 10 or after the onset of puberty, whenever there is overweight/obesity associated with at least one additional risk factor (RODACKI et al., 2024).

In addition to glycemic control, the follow-up of patients with DM2 should include periodic evaluation of micro and macrovascular complications, as well as associated conditions. Systematic screening of these conditions enables early interventions, reducing morbidity and mortality and improving quality of life. Among the complications monitored are diabetic retinopathy, nephropathy and neuropathy, as well as cardiovascular diseases, such as hypertension and atherosclerosis. Problems such as diabetic foot, obesity and emotional changes also require continuous attention. For this, laboratory and ophthalmological tests, clinical evaluations, and tools such as glycated hemoglobin, capillary glucose, and lipid profile are used, integrating a broad approach to prevention and care (ADA, 2023; SBD, 2024).

Early diagnosis of DM allows for the immediate adoption of glycemic control strategies, lifestyle changes, and interventions that reduce the risk of complications. Because T2DM often has a silent evolution, serious complications can set in before clinical manifestation. Thus, routine exams and regular medical follow-up are essential to monitor glycemic control, adjust therapies, and prevent disease progression (OLIVEIRA et al., 2023).

2.2.5 Treatment

The treatment of type 2 diabetes mellitus (DM2) involves a multifactorial approach, whose central objective is to maintain glycemic control, prevent acute and chronic complications, and promote the improvement of the patient's quality of life. This management is based on three main pillars: lifestyle changes, pharmacological treatment, and continuous monitoring (OLIVEIRA et al., 2023; COUTO et al., 2024).

In the non-pharmacological sphere, health education and the modification of lifestyle habits are indispensable measures. It is recommended that the patient adopt a balanced diet, with individualized nutritional guidance, taking into account both the quality and quantity of calories ingested. This approach aims not only at normalizing blood glucose, but also at reducing cardiovascular risk factors, with emphasis on body weight control. In addition, the regular practice of physical activity plays a fundamental role, since it increases peripheral glucose uptake, contributes to the reduction of insulin resistance, favors weight control, and promotes cardiovascular benefits. In addition, smoking cessation and moderation in alcohol consumption are essential strategies to reduce the risk of complications (OLIVEIRA et al., 2023; COUTO et al., 2024).

It is important to emphasize that such changes should be encouraged from the beginning of treatment, due to their relevance in maintaining a healthy weight and preventing complications. The prescription of physical activity should be carried out in an individualized

and progressive manner, considering the patient's clinical conditions, reinforcing the need for continuous adherence to an active lifestyle as an integral part of the overall therapy of DM2 (OLIVEIRA et al., 2023; COUTO et al., 2024).

When non-pharmacological measures are insufficient to achieve glycemic goals, it becomes necessary to introduce drug treatment. Therapeutic options include oral agents and insulin, selected according to the stage of the disease and the individual characteristics of each patient. Oral drugs, generally used as the first line of treatment, include classes such as biguanides, sulfonylureas, dipeptidyl peptidase 4 (DPP-4) inhibitors, and glucagon-like peptide-like receptor agonists type 1 (GLP-1), each of which acts on different mechanisms of the pathophysiology of DM2. This diversity of options allows for a personalized approach, which considers the individual's clinical and metabolic profile (OLIVEIRA et al., 2023; COUTO et al., 2024).

Among the available drugs, metformin, belonging to the biguanide group, is considered the drug of choice due to its proven efficacy in reducing hepatic glucose production, improving insulin sensitivity, and a consolidated safety profile. As the disease progresses or when the initial therapeutic response is not sufficient, other agents can be associated to achieve adequate glycemic control and reduce the risk of complications (OLIVEIRA et al., 2023; COUTO et al., 2024).

In certain cases, insulin therapy becomes necessary, especially in patients with unsatisfactory glycemic control, the presence of advanced complications, or treatment failure due to the progressive reduction in pancreatic insulin secretion, characteristic of DM2. Insulin can be used as monotherapy or in combination with oral agents, and the therapeutic regimen and dosage should be individualized according to the glycemic profile and the specific needs of the patient (OLIVEIRA et al., 2023; COUTO et al., 2024).

Clinical follow-up should be continuous and structured, including periodic assessment of glycated hemoglobin (HbA1c), monitoring of capillary glucose or continuous systems in patients using insulin or at risk of hypoglycemia, in addition to laboratory tests to assess renal function, lipid profile, and liver function. It is also recommended that periodic ophthalmological, neurological and cardiovascular evaluation be carried out, in order to enable early screening of complications. In the long term, the goal of treatment is to prevent complications that compromise the quality of life, productivity, and survival of individuals with DM2 (OLIVEIRA et al., 2023; COUTO et al., 2024; SANTOS et al., 2024).

Finally, it is highlighted that treatment must be individualized, taking into account the patient's age, presence of comorbidities, cardiovascular risk, renal function, and personal preferences. A multidisciplinary approach, involving physicians, nutritionists, nurses, physical

educators, and other health professionals, is essential to favor treatment adherence and optimize long-term results (OLIVEIRA et al., 2023; COUTO et al., 2024; SANTOS et al., 2024).

2.3 HEALTH PROGRAMS FOR DIAGNOSIS AND FOLLOW-UP - HIPERDIA

The HIPERDIA Program (System for the Registration and Monitoring of Hypertensive and Diabetic Patients) was established in 2002 by the Ministry of Health, in the context of the Plan for the Reorganization of Care for Systemic Arterial Hypertension (SAH) and Diabetes Mellitus (DM). Its purpose is to establish goals and guidelines that expand the prevention, diagnosis, treatment, and control actions of these diseases, through the reorganization of the work process in Primary Health Care (PHC) (BACURY et al., 2023).

The process begins with the registration of the patient at the Basic Health Unit (UBS), at which time clinical, socioeconomic and epidemiological information is collected. This registry enables the planning of actions aimed at the prevention, treatment and monitoring of cases, in addition to providing strategic data to support public policies and guide the allocation of resources. Another relevant aspect of HIPERDIA is risk stratification, which allows prioritizing the follow-up of more vulnerable patients, especially those with cardiovascular, neuropathic, or renal complications (BRASIL, 2021; SBD, 2024).

In addition to early diagnosis, the program has regular monitoring as its central axis. Among the follow-up actions are: periodic measurement of capillary glucose and blood pressure, request and analysis of laboratory tests, such as glycated hemoglobin and lipid profile, as well as guidance on lifestyle changes. This continuous follow-up seeks to reduce the risk of acute and chronic complications, such as diabetic ketoacidosis, cardiovascular events, kidney failure, and amputations resulting from the diabetic foot (BRASIL, 2021; SBD, 2024).

Health education is another essential component of HIPERDIA. The program promotes educational activities that involve guidance on healthy eating, regular physical activity, adherence to drug treatment and prevention of risk factors, such as smoking and excessive alcohol consumption. This comprehensive approach contributes to greater adherence to treatment and to improving the quality of life of patients (BRASIL, 2021).

In the scope of management, HIPERDIA provides strategic information to the managers of the Unified Health System (SUS), supporting the organization of care flows and the planning of campaigns aimed at prevention and diagnosis on a large scale. The integration between different professionals, doctors, nurses, nutritionists, pharmacists, and

community health agents, strengthens the multiprofessional character of care, ensuring more efficient care, centered on the patient's needs (SOARES et al., 2024).

Thus, HIPERDIA is configured not only as an instrument for the clinical control of diabetes and hypertension, but also as a strategy capable of reducing the morbidity and mortality associated with these conditions. It represents, therefore, a relevant milestone in the strengthening of public health policies in Brazil (BRASIL, 2021; SBD, 2024; SOARES et al., 2024). The implementation of follow-up programs, such as HIPERDIA, represents an advance in the control of hypertension and diabetes by structuring care flows and promoting adherence to treatment. However, for these programs to fully achieve their objectives, it is essential to integrate the evaluation of clinical and laboratory biomarkers, which provide accurate information on the patient's health status. These indicators allow for early identification of diseases and complications, providing support for more assertive clinical decisions and for reducing the morbidity and mortality associated with these diseases.

3 FINAL CONSIDERATIONS

Systemic arterial hypertension and type 2 diabetes mellitus share etiological determinants, pathophysiological mechanisms, and clinical repercussions that require an integrated and continuous approach. Effective control of these diseases depends on early identification, regular monitoring, and adherence to pharmacological and nonpharmacological treatment. In this context, multidisciplinary action, associated with health education strategies and follow-up programs such as HIPERDIA, is essential to reduce complications, promote self-care, and qualify the care provided to affected individuals.

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