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Original article

Hypertension in Children in Kirkuk City

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Abstract:

- ***Background*:** Hypertension is a significant risk factor for cardiovascular morbidity and mortality, not only in adults but also in the pediatric population. There is a rising prevalence of hypertension in children, driven primarily by the increasing rates of obesity. This study aimed to clarify the etiology of hypertension in children, determine the distribution of age and gender in pediatric hypertension, and identify risk factors associated with hypertension in children.
- ***Methods:*** A descriptive, cross-sectional study was conducted at the pediatric hospital in Kirkuk city and the Baghdad Road polyclinic from January 2021 to January 2022. A total of 260 children aged 1 to 14 years were included in the study. Clinical data, including body mass index (BMI), renal function tests, serum electrolytes, lipid profiles, and serum cortisol for hypertensive patients, were collected. Hypertension diagnosis and classification were based on systolic and diastolic blood pressure percentiles.
- ***Result:*** Hypertension was identified in 13 (5%) children. Of these, 5 (2%) had primary hypertension, mostly associated with obesity (BMI >30 kg/m²), and 8 (3%) had secondary hypertension, with renal impairment as the most common cause. All hypertensive patients exhibited dyslipidemia. The incidence of hypertension was significantly higher in older age groups (7-10 years and 11-14 years). A significant correlation was found between obesity and hypertension ($p<0.05$).
- ***Conclusions:*** Secondary hypertension is more common than primary hypertension in children, with renal impairment being the most frequent cause. Obesity plays a critical role in the development of primary hypertension in children. Early screening and intervention are essential to prevent long-term cardiovascular complications.
- **Keywords:** Hypertension, children, BMI

INTRODUCTION

Hypertension is a significant risk factor for cardiovascular morbidity and mortality, not only in adults but also in children, where pediatric hypertension is becoming increasingly common. Hypertension is known to be a major contributor to morbidity and mortality globally, and the long-term health risks to children with hypertension can be substantial (1).

Hypertension in children is defined as an average systolic blood pressure (SBP) and/or diastolic blood pressure (DBP) that is ≥95th percentile for age, sex, and height. Elevated blood pressure is defined as an average SBP or DBP that is ≥90th percentile but <95th percentile. In adolescents beginning at age 12, prehypertension (elevated BP) is defined as BP between 120/80 mm Hg and the 95th percentile. A child with BP levels ≥95th percentile in a medical setting but normal BP outside of the office is considered to have white coat hypertension (2).

Stage I hypertension is diagnosed if a child's BP is greater than the 95th percentile but less than or equal to the 99th percentile plus 5 mm Hg, while Stage II hypertension is diagnosed if a child's BP is greater than the 99th percentile plus 5 mm Hg (3). If the systolic and diastolic pressures lead to discrepancies in classification, the child's condition is categorized using the higher value (4).

In infants and young children, systemic hypertension is uncommon, with a prevalence of <1%. However, when present, it is often indicative of an underlying disease process (secondary hypertension). Severe and symptomatic hypertension in children is typically due to secondary hypertension. In contrast, the prevalence of primary essential hypertension, particularly in older children and adolescents, has increased, correlating with the rise of obesity (5). The influence of obesity on elevated BP is evident in children as young as 2-5 years old. Obesity, chronic kidney diseases, renovascular diseases, congenital cardiovascular diseases, and various

endocrine disorders are the primary causes of secondary hypertension in pediatrics. The complications of hypertension can severely impact cardiovascular and kidney health (5).

From a public health perspective, reliable estimates of the prevalence of childhood hypertension are crucial for formulating appropriate prevention, treatment, and health resource allocation strategies. Despite numerous studies assessing the prevalence of hypertension in children and adolescents, global synthesis of these prevalence estimates remains limited (6).

PATIENT and METHOD

The study is a community-based descriptive cross-sectional study conducted with 260 children who presented to the pediatric hospital in Kirkuk city and the Baghdad Road polyclinic in Kirkuk city from January 1, 2021, to January 1, 2022. A questionnaire was used to collect relevant data, including the children's age, weight, height, and family and medical history.

Blood pressure (BP) measurements were performed using a sphygmomanometer with a BP cuff appropriate for the size of the child's arm. The BP was measured with the child sitting in a quiet position for at least five minutes. Special attention was given to selecting the correct cuff size to avoid misdiagnosis, as a cuff that is too small or narrow could artificially elevate BP readings. An appropriately sized cuff has an inflatable bladder that covers at least 40% of the arm's circumference at the midpoint of the upper arm and should cover at least two-thirds of the upper arm's length and 80-100% of its circumference.

The height percentile of each child was determined using standard height charts. SBP and DBP were measured and recorded, and the correct gender table was used for comparison. The child's age was located on the left side of the table, and the corresponding BP percentiles

(50th, 90th, 95th, and 99th) were used to classify the child's BP. BP values below the 90th percentile were classified as normal, BP between the 90th and 95th percentiles were considered prehypertension, and BP values above the 95th percentile were classified as hypertension. If the BP readings were above the 90th percentile, they were repeated twice during the same visit, and the average SBP and DBP were calculated. If BP readings were above the 95th percentile, they were staged according to the criteria provided in the guidelines. Stage 1 hypertension was defined as BP between the 95th percentile and the 99th percentile plus 5 mmHg, while Stage 2 hypertension was diagnosed if BP exceeded the 99th percentile plus 5 mmHg.

In children under 3 years of age, BP measurements were taken if they had a history of prematurity, very low birth weight, or any neonatal complications requiring intensive care. BP measurements were also taken for children with congenital heart disease, recurrent urinary tract infections, hematuria, or proteinuria, known renal disease, urologic malformations, family history of congenital renal disease, solid organ transplants, malignancy or bone marrow transplants, treatment with drugs that elevate BP, or other systemic conditions associated with hypertension, such as neurofibromatosis, tuberous sclerosis, or elevated intracranial pressure.

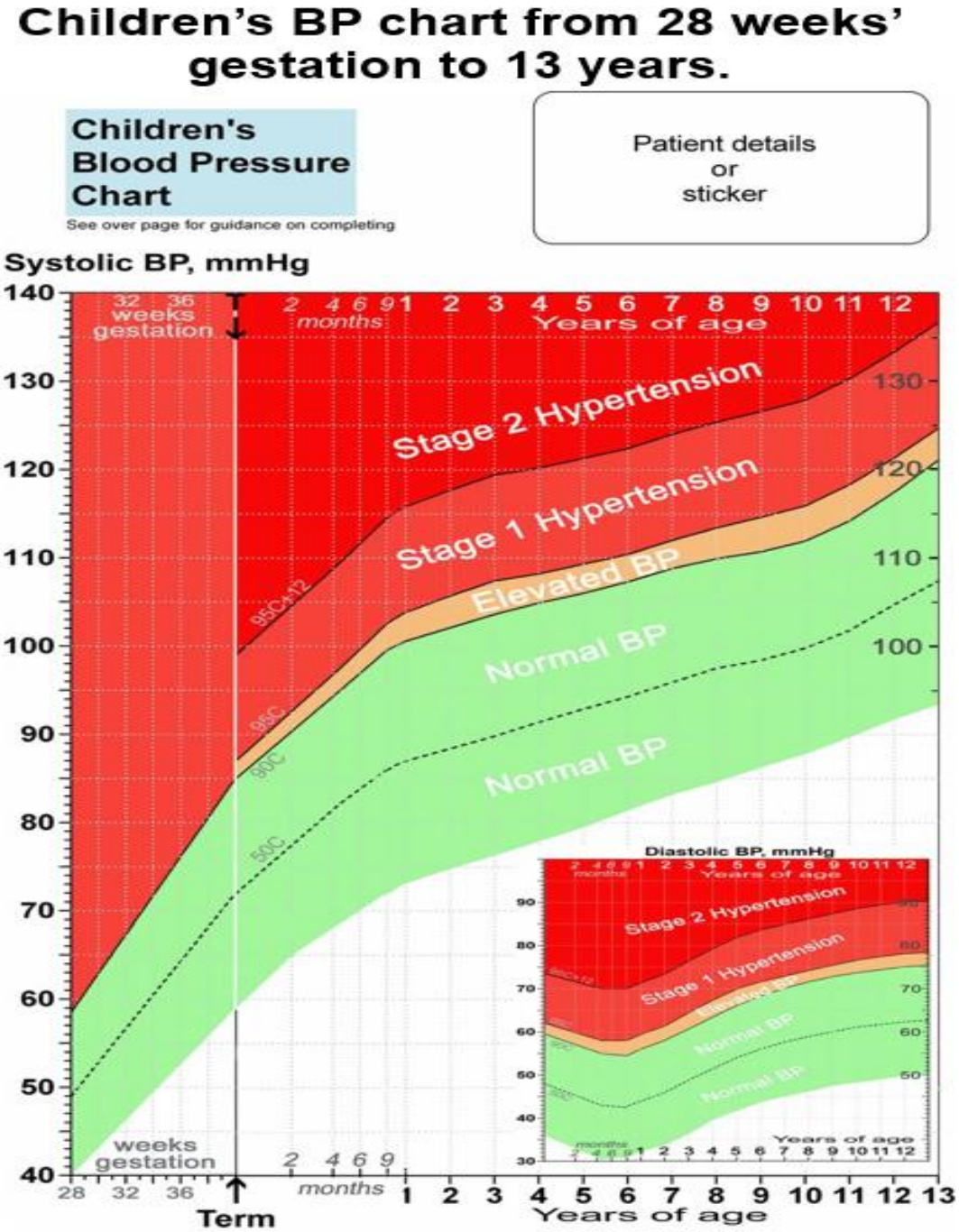

Figure 1: Blood pressure chart

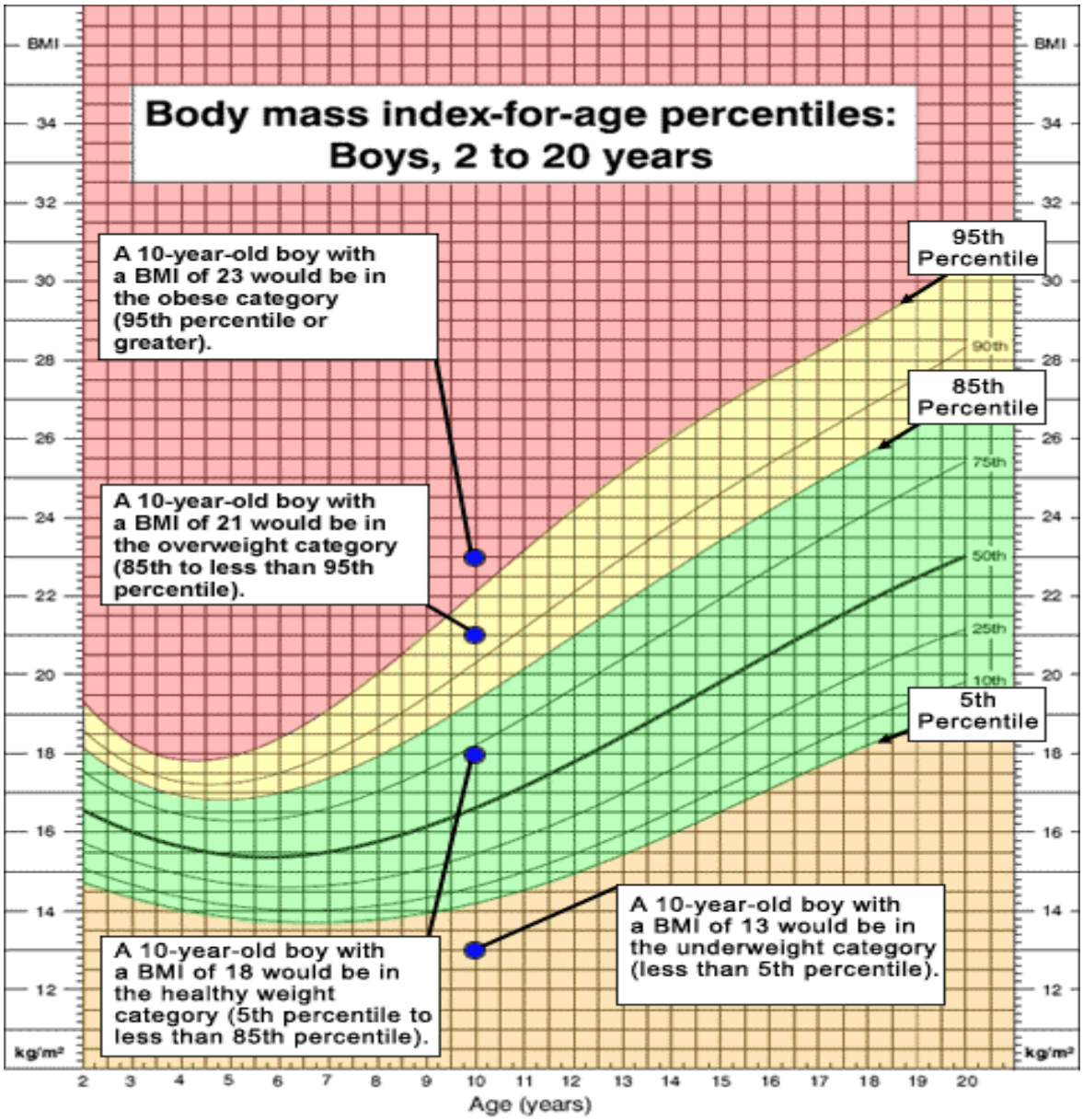

Figure 2: Growth chart, used to assess the BMI of the male children

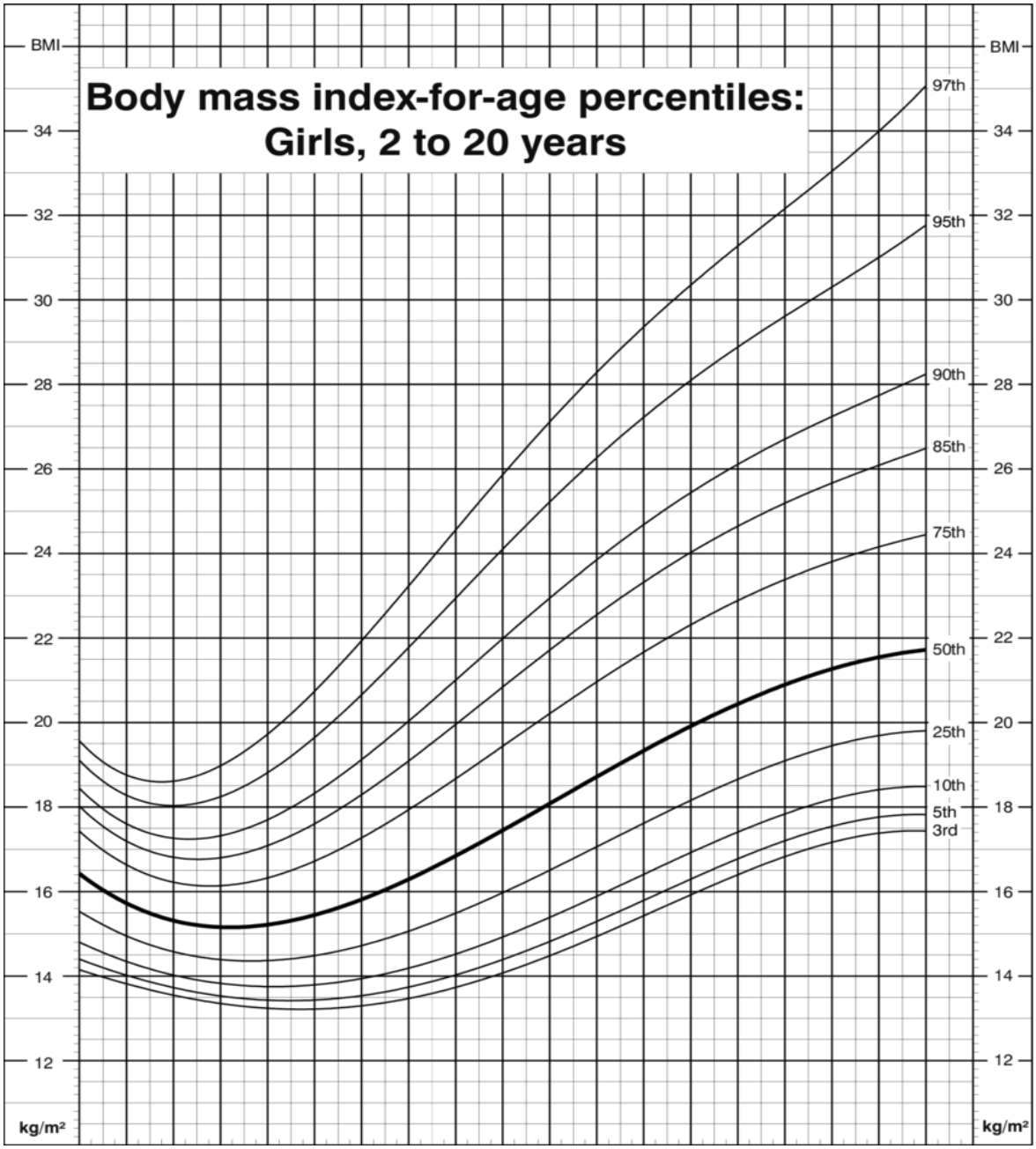

Figure 3: Growth chart, used to assess the BMI of the female children

RESULTS

In this study, the demographic data revealed that the sample comprised 250 patients, with 155 females (60%) and 105 males (40%) (Table 1). The distribution of the sample according to age was as follows: 22 patients (8%) were aged 1-3 years, 43 patients (17%) were aged 4-6 years, 96 patients (37%) were aged 7-10 years, and 99 patients (38%) were aged 11-14 years (Table 2).

Table 1. Demographic data

Socio-demographic parameter	%	NUMBER
FEMALE	60%	155
MALE	40%	105

Table 2: Distribution of the Sample According to their Age

Age Group	Total	Percentage %
1-3 years	22	8%
4-6 years	43	17%
7-10 years	96	37%
11-14 years	99	38%

The incidence of hypertension in the study sample was 5%, with 13 out of 250 patients diagnosed as hypertensive. This finding was statistically significant, with a p-value of <0.05 (Table 3). Among the 13 hypertensive patients, 5 (38%) had primary hypertension, and 8 (62%) had secondary hypertension, with the latter being statistically significant (p-value <0.05) (Table 4).

Table 3: hypertension incidence in the sample

Percentage (%)	Number of patients	Hypertension
5	13	Yes
95	247	No
100	260	Total

p-value <0.05%

Table 4: The types of Hypertension

Hypertension type	Number of hypertensive patients	Percentage
Primary	5	38
Secondary	8	62
Total	13	100

p-value <0.05%

Regarding the stage of hypertension, 7 patients (54%) had stage 1 hypertension, and 6 patients (46%) had stage 2 hypertension. This categorization was based on the blood pressure readings, with stage 1 being diagnosed for BP readings between the 95th and 99th percentiles plus 5 mmHg, and stage 2 being diagnosed for BP exceeding the 99th percentile plus 5 mmHg (Table 5).

Table 5: Stage of hypertension

Stage of hypertension	TOTAL	%
Elevated blood pressures	13	54
Stage 1 HT	7	46
Stage 2 HT	6	100

The relationship between BMI and hypertension was also examined. Among the 13 hypertensive patients, 2 (15%) were underweight, 1 (7.5%) had a healthy weight, 2 (15%) were overweight, and 8 (61.5%) were obese. This finding was statistically significant with a p-value of <0.05 (Table 6).

Table 6: The relationship between BMI and hypertension

	TOTAL	%
UNDERWEIGHT	2	15
HEALTHY WEIGHT	1	7.5
OVERWEIGHT	2	15
OBEISE	8	61.5

p-value <0.05%

Finally, the causes of secondary hypertension were explored. Among the 8 patients with secondary hypertension, 6 (75%) had renal impairment, 7 (87.5%) had dyslipidemia, 1 (12.5%) had elevated serum cortisol (diagnosed with Cushing syndrome), and 1 (12.5%) had renal artery stenosis. This distribution was also statistically significant with a p-value of <0.05 (Table 7).

Table 7: Causes of secondary hypertension.

Causes of hypertension	Number of patients	Percentage
Renal impairment	6	75
Dyslipidemia	7	87.5
Serum cortisol	1	12.5
Renal artery stenosis	1	12.5

p-value <0.05%

DISCUSSION

Hypertension is a sustained elevation of resting systolic and/or diastolic blood pressure, with abnormal blood pressure readings varying in children depending on age. Hypertension without a known cause, referred to as primary hypertension, is the most common type in children, similar to its prevalence in adults. Secondary hypertension, which has an identifiable cause, is relatively rare in children. Typically, children with hypertension may not show symptoms or complications during childhood, though these may develop later. Diagnosis of hypertension in children is confirmed using sphygmomanometry. Additionally, tests are conducted to identify any underlying causes of secondary hypertension. Treatment generally includes lifestyle changes, medications, and addressing treatable causes (7, 8).

Hypertension in children and adolescents is becoming an increasingly recognized health issue that is often overlooked. It is recommended that children undergo annual blood pressure screenings starting at the age of three, or during every visit if risk factors are present. In children younger than 13 years, elevated blood pressure is defined as having a systolic or diastolic pressure at or above the 90th percentile for their age, height, and sex, while hypertension is defined as blood pressure at or above the 95th percentile. For adolescents aged 13 years or older, elevated blood pressure is defined as a systolic pressure between 120-129 mm Hg and a diastolic pressure less than 80 mm Hg. Hypertension in this group is defined as a reading of 130/80 mm Hg or higher (1). In this study, the incidence of hypertension was found to be 5% (p-value <0.05), a figure consistent with other studies (2, 3). The study also found that hypertension is more common in children aged 7-10 years and 11-14 years (p-value <0.05), which aligns with findings from a study by Cynthia S. Bell et al. in the USA, where hypertension was most prevalent in these age groups. Obesity emerged as a significant contributor to hypertension, with a strong correlation between elevated BMI and the incidence of hypertension. Obesity in children increases the risk of hypertension by three times and significantly contributes to morbidity by raising the likelihood of conditions such

as diabetes and dyslipidemia, all of which exacerbate cardiovascular complications. Factors such as overactivity of the sympathetic nervous system (SNS), insulin resistance, and changes in vascular structure and function may all play a role in obesity-related hypertension in children (9-11).

Secondary hypertension is more commonly seen in children than in adults. It may present in adolescents, particularly when physical findings deviate from those typically associated with essential hypertension. Renal disease remains the most common cause of secondary hypertension in children, followed by endocrine disorders like pheochromocytoma and hyperthyroidism, and pharmaceutical causes such as oral contraceptives, sympathomimetics, and some over-the-counter preparations. Other contributing factors include post-streptococcal nephritis, hemolytic uremic syndrome, and polycystic kidney disease (12, 13).

Hypertension in children and adolescents is a critical pathology, with a guarded prognosis. It is associated with both modifiable and non-modifiable factors, making early screening, diagnosis, and identification of underlying causes essential. Given the prevalence of secondary hypertension in pediatric patients, early intervention is crucial for managing blood pressure and preventing the potential long-term complications associated with hypertension (13).

CONCLUSION

Secondary hypertension is more common than primary hypertension in children, with renal impairment being the most frequent cause. Obesity plays a critical role in the development of primary hypertension in children. Early screening and intervention are essential to prevent long-term cardiovascular complications.

Ethical Clearance:

In accordance with the 2013 WMA Helsinki Declaration, all ethical aspects of this study were approved. Before enrolling the participants, an informed oral consent was obtained from their families as an ethical agreement. Additionally, approval from the hospital administrator was obtained.

Financial support and sponsorship:

Nil.

Conflicts of interest:

There are no conflicts of interest.

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