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Original Research Article

Elevated blood pressure in the paediatric population: the Nigerian experience

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ABSTRACT

Background: The prevalence of hypertension in children is increasing, hence the need for updated information on the causes, clinical assessment, and treatment of childhood hypertension among Pediatricians. This study assessed the experiences and challenges in the management of childhood hypertension among Pediatricians in Nigeria.
Methods: The study was a cross-sectional study conducted from responses from 73 Paediatric cardiologists and residents. An online self-administered structured questionnaire was used to collect information from participants. The results were analyzed using Statistical Package for the Social Sciences (SPSS) version 25.
Results: Sixty-nine (94.5%) participants practiced at the tertiary level of health care. Respondents came from the country's geopolitical zones, mostly the south West (39.7%). About a third (31.5%) of children have elevated blood pressure on average. The availability of age-appropriate blood pressure monitoring instruments increased with age (from 60.3% in infants to 94.5% in adolescents). The nephrologist manages childhood hypertension in most centers (38.4). Secondary hypertension was the more common cause reported by respondents (91.8%), and acute glomerulonephritis (22.3%) and renal parenchymal disease (15.6%) were the leading causes. Almost half 34 (46.6%) are aware of guidelines for the management of hypertension in children, but only 64.7% of these use any. The calcium channel blockers (72.9%) are the leading antihypertensives used by respondents, and hydralazine is used for hypertensive emergencies.
Conclusions: There are still challenges with the diagnosis and management of childhood hypertension in Nigeria. Providing age-appropriate BP measurement equipment and following management guidelines would enhance the care of childhood hypertension nationwide.

Keywords: Childhood hypertension, Antihypertensives, Guidelines

INTRODUCTION

A blood pressure above the 90th percentile for age, height, and gender indicates elevated blood pressure in children under 13 years. Values above the 95th percentile and 99th percentile are defined as stage 1 and stage 2 hypertension, respectively.[1] In children 13 years or older, elevated blood pressure is defined by a systolic BP of 120 to 129 and a diastolic BP of less than 80 mmHg, while hypertension is a BP of 130/80 mmHg or higher.[1]

Although less common in children than adults, it is increasingly becoming a major health concern worldwide, both from an increasing prevalence and recent findings that hypertension in adulthood may have its origin in childhood hypertension.[2,3]

The global prevalence of hypertension is estimated to be 2-4%.[4] Variations exist in the prevalence of hypertension in children from studies conducted in Nigeria. Prevalence rates of 3.0 and 3.5 percent were reported from north-central and south-south Nigeria, respectively.[2-5] Systematic reviews of data obtained from Nigeria showed a prevalence of 5.1 percent, and a systematic review from Africa reported 5.5 percent.[3-6] Differences in the guidelines used to define hypertension are partly responsible for the differences in prevalence rates reported from different studies.[7,8]

Routine screening for high blood pressure is recommended in children from the age of three years. Screening is also recommended below the age of three if there are risk factors for hypertension.[1-9] Ideal blood pressure measurement is done after a 3-5 minute rest, with the child seated, back supported, feet flat on the floor, and using the appropriate cuff size.[1] Accurate blood pressure readings in children are affected by a variety of factors that include the office or clinic setting, the device used, and the availability of an appropriate cuff size for the different paediatric age groups. Studies have shown that repeated blood pressure measurements in the same visit tend to produce lower values.[9] Therefore, for children with an initially elevated blood pressure value, an average of three measurements obtained from the right arm at three different visits is recommended.[10] Both auscultatory and oscillometric methods of measurement are available, but oscillometric devices have been shown to overestimate both the systolic and diastolic blood pressures.[11,12] For children with an initially oscillometrically measured elevated blood pressure, it is recommended that repeat measurements be obtained with an auscultatory device. These emphasize the importance of appropriate devices for accurate blood pressure assessment, which will influence both clinical management and epidemiologic reports on the prevalence of hypertension in children.

Similar to adults, the aetiology of hypertension in children is diverse and is generally classified as primary or secondary. While secondary hypertension is a result of identifiable underlying medical conditions, primary hypertension is diagnosed in the absence of any identifiable cause and is often associated with the presence of risk factors like a positive family history and obesity.[13] Secondary hypertension has been widely reported to be more common among preadolescents and primary hypertension in adolescents.[14] However, studies are reporting an increasing prevalence of primary hypertension in children.[1-15] Although renal parenchymal disease, coarctation of the aorta, endocrine disorders, and chronic steroid use are among the leading causes of secondary hypertension in children, periodic review of the providers' experiences with common aetiologies of hypertension in their practice will thus be appropriate to identify any changing pattern promptly.[1-9]

Guidelines on the definition, assessment, and management of hypertension in children have been available for decades. They are intended to guide Paediatricians on the management of paediatric hypertension, and are periodically reviewed. The extent of awareness of these guidelines, their use, and the protocols for the management of paediatric hypertension in Nigeria has yet to be determined. This study, therefore, seeks to assess the experience and challenges of hypertension in paediatric care in Nigeria. The specific objectives are to document the experiences and challenges in diagnosing hypertension among Nigerian children, to compare the common causes of hypertension among Nigerian children with those in other parts of the world, and to document the treatment of hypertension among Nigerian children and compare it with international guidelines.

METHODS

The study was a cross-sectional study conducted among Paediatricians involved in Paediatric Cardiology care in Nigeria using an online survey in July 2024. Paediatric cardiology care in Nigeria is overseen by consultant cardiologists, assisted by resident doctors and other support staff. Virtually all Paediatric cardiology care in Nigeria is provided in tertiary healthcare facilities, which are mostly owned by the federal and state governments, as well as a few private individuals. Most of these facilities are in urban centers. Data for this study were collected via convenience sampling. The data collection instrument was a self-administered questionnaire distributed online via an online group consisting of paediatric cardiologists and resident doctors involved in paediatric cardiology care. Respondents were from the country's political zones. The questionnaire was sent to the group, and all members were requested to respond as part of convenience sampling. Responses were received over 2 weeks.

The study questionnaire consisted of sections on biodata, the healthcare facility, and the healthcare facility's geopolitical zone. Details were also obtained on whether blood pressure is routinely monitored in children across age groups, the availability of appropriate cuffs for blood pressure monitoring in each group, and the average frequency of diagnosing elevated BP or hypertension at the center. We also obtained data on which paediatric subspecialty is primarily involved in the management of children with elevated blood pressure, the common causes of hypertension in children seen at the healthcare facility, and the 3 most common causes in the centre. Information on the respondent's awareness and use of guidelines for the management of hypertension was also sought. Respondents were also asked to indicate which

antihypertensive is used as first-line treatment for newly diagnosed hypertension, hypertensive emergencies, and hypertensive urgencies. Data analysis was done with SPSS version 25. Categorical variables were described using percentages and modes and compared using the chi-squared test. Ethical approval was not required for the study because it was a quality assurance audit, an internal evaluation and performance review conducted by an organization as part of good practice. The research involved surveys that do not involve identifiable participants. Researchers informed all participants why the research is being conducted, anonymity is assured. Participants were fully informed about the aims of the research and if there are any risks associated.[16]

RESULTS

A total of seventy-three pediatricians responded to the questionnaire. Sixty-nine (94.5%) were from public tertiary health care centers and 4 (5.5%) from privately-owned centers.

Table 1: Demographic variables of respondents (n=73).

Variable	Frequency (N)	Percentage (%)
Workplace of the respondent		
Public	69	94.5
Private	4	5.5
Geopolitical zone		
South West	29	39.7
North Central	17	23.3
North West	11	15.1
South South	8	11.0
North East	6	8.2
South East	2	2.8

Table 2: Frequency of diagnosing elevated blood pressure.

Frequency of diagnosis	Number	Percentage (%)
Monthly	23	31.5
Quarterly	15	20.5
Weekly	11	15.1
Yearly	7	9.6
Six-monthly	5	6.8
Once in a while	2	2.7
Rarely	2	2.7
Very rarely	1	2.7
Daily	1	2.7
Occasionally	1	2.7
Not regularly	1	2.7
3-times a week	1	2.7
Non-respondents	3	4.1

Table 3: Availability of facilities to monitor blood pressure in different age groups.

Age group	Frequency (N)	Percentage (%)
Infants		
Yes	44	60.3
No	26	35.6
Not sure	3	4.1
1–5-year-old		
Yes	59	80.8
No	13	17.8
Not sure	1	1.4
6–10-year-old		
Yes	65	89.1
No	5	6.8
Not sure	2	2.7
Non respondents	1	1.4
11–15-year-old		
Yes	69	94.5
No	4	5.5

Table 4: Does the facility routinely measure blood pressure in different age groups.

Age group	Frequency (N)	Percentage (%)
Infants		
Yes	9	12.3
No	64	87.7
1–5-year-old		
Yes	18	24.6
No	55	75.4
6–10-year-old		
Yes	29	39.7
No	42	57.5
Not sure	1	1.4
Non respondents	1	1.4
11-15-year-old		
Yes	34	46.5
No	38	52.1
Not sure	1	1.4

Table 5: Paediatric specialists who manage a child with hypertension (n=73).

Personnel	Frequency (N)	Percentage (%)
Nephrologist	28	38.4
Cardiologist	20	27.4
Either	21	28.8
Both	2	2.7
General pediatrician	2	2.7

Most of the respondents were in the south West (29,39.7%) and the north Central geopolitical zones

(Table 1). Most respondents (23,31.5%) indicated that they encounter a child with elevated blood pressure on average once a month, while 7 (9.6%) encounter them once a year on average. There were 3 (4.1) non-respondents. (Table 2). 44 (60.3%) respondents had age-appropriate equipment for measuring blood pressure in infants at their workplaces. This increased gradually to 69 (94.5%) for adolescents (Table 3).

Table 6: Causes of hypertension identified by respondents.

Etiology of hypertension	Frequency (N)	Percentage (%)
Acute glomerulonephritis	40	22.3
Parenchymal renal disease	28	15.6
Other kidney and urinary tract diseases	22	12.3
Obesity	22	12.3
Chronic steroid use	20	11.2
Systemic lupus erythematosus	14	7.8
Essential hypertension	11	6.1
Coarctation of the aorta	11	6.1
Renal artery stenosis	8	4.5
CAKUT	1	0.6
Nephrotic syndrome	1	0.6
Chronic kidney disease	1	0.6
Total	179	100.0

CAKUT: Congenital Anomalies of the Kidney and Urinary Tract.

Table 7: Awareness and use of guidelines in the management of hypertension.

	Frequency (n=73)	Percentage (%)
Are you aware of any guidelines for the management of hypertension in children?		
Yes	34	46.6
No	38	52.0
Non-responders	1	1.4
	Frequency (n=34)	**Percentage (%)**
Do you use any guidelines for the management of hypertension in children?		
Yes	22	64.7
No	12	35.3

There was also a gradual increase in the proportion of respondents who routinely measure blood pressure from 9 (12.3%) in infants to 34 (46.5%) in adolescents (Table 4). The nephrologist manages hypertension in 38.4% of the respondents, and the cardiologist in 27.4%. Combined management by both the cardiologist and nephrologist was reported by 2 (2.7%) respondents (Table 5). Respondents indicated secondary hypertension (67;91.8%) as the commonest cause of hypertension in children. Acute glomerulonephritis (22.3%) and parenchymal renal disease (15.6%) were the most prevalent causes identified (Table 6).

Table 8: Awareness of guidelines for the treatment of hypertension.

Guideline	Frequency (N)	Percentage (%)
AAP	22	25.0
ESC/ESH	8	9.1
NICE	3	3.4
ACC/AHA	3	3.4
NHS	2	2.3
ISH	2	2.3
KDIGO	2	2.3
ESPN	1	1.1
Child-1	1	1.1
IPNA	1	1.1
JNC	1	1.1
NBHEPH	1	1.1
Baylor school of health	1	1.1
Not aware of any	36	41.0
Non-responders	4	4.6
Total	88	100.0

Table 9: Guidelines used by respondents for the treatment of hypertension.

Guideline	Frequency (N)	Percentage (%)
AAP	12	54.6
ACC/AHA	2	9.2
KDIGO	2	9.2
ESH	1	4.5
Child-1	1	4.5
ISH	1	4.5
IPNA	1	4.5
JNC	1	4.5
Baylor school of health	1	4.5
Total	22	100.0

About half of the respondents (34,46.6%) are aware of guidelines for the management of hypertension, but only 22 (64.7%) use at least one guideline in its management (Table 7). Respondents were mostly aware of the American Academy of Pediatrics (AAP) guideline (25.0%) and the European Society of Cardiology/ European Society of Hypertension (ESC/ESH) guideline (9.1%), as shown in Table 8. Among the 22 respondents who use guidelines, the AAP guideline was the most frequently used (54.6%) (Table I9). Calcium channel blockers (CCBs) were the most frequently used first-line

agents in the management of hypertension (51;72.9%), followed by angiotensin-converting enzyme inhibitors (10;14.3%), diuretics (7;10.0%), and alpha-methyldopa (2; 2.8%). The CCBs Are also the most frequently used for hypertensive urgencies, 34 (49.2%). However, in hypertensive emergencies, hydralazine (35,49.3%) and labetalol (27,38.0%) were the most frequently used (Table 10).

Table 10: Use of antihypertensives in the management of hypertension by respondents.

Antihypertensive	First line for hypertension (n=70)		Hypertensive urgency (n= 69)		Hypertensive emergency (n=71)	
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)
Calcium channel blockers	51	72.9	34	49.2	6	8.5
ACE-I	10	14.3	3	4.3	2	2.8
Diuretics	7	10.0	-	-	1	1.4
Alpha-methyldopa	2	2.8	1	1.5	-	-
Hydralazine	-	-	16	23.2	35	49.3
Labetalol	-	-	14	20.3	27	38.0
Sodium nitroprusside	-	-	1	1.5	-	-
Total	70	100.0	69	100.0	71	100.0

There were 5 non-responders; 1 responder indicated referral of all cases of hypertensive urgency and emergency.

DISCUSSION

Accurate determination of blood pressure (BP) can be achieved only by intra-arterial BP monitoring.[17] This is, however, invasive and not frequently used in clinical practice. Routine BP measurements are thus performed with easy-to-use, noninvasive blood pressure cuffs and a stethoscope, using Korotkoff sounds. This equipment is available in various forms, including aneroid and mercury sphygmomanometers, automated oscillometric devices, automated auscultatory devices, and semi-automated devices.[17] In children, the sizes needed for reliable measurements vary with age; thus, the non-availability of appropriate cuffs will negatively affect the determination of BP in day-to-day clinical examination. In this study, appropriate cuffs for BP measurement in infants and 1–5-year-olds were largely unavailable in many centers. This finding is a cause for concern in the health care facilities in Nigeria, as it suggests elevated BP in infants may go undetected even in high-risk groups. It is also particularly worrisome, given that the respondents were almost all from tertiary health care facilities. The availability of appropriate cuffs for infants and under-fives at lower levels of health care is only better imagined.

Although many of the respondents reported diagnosing hypertension on average every month and quarterly, this report may not be a true reflection of the prevalence of childhood hypertension in the various centers because of the widespread non-availability of blood pressure cuffs. This unavailability may also partly explain why many respondents do not routinely monitor their patients' blood pressure, even in age groups where it is recommended. Many cases might have been missed as a result. A similar report came from a study in the United States, in which participants identified inappropriate devices and blood pressure cuffs as important barriers to BP assessment in children.[15] Recall bias may also impair the responses in this study.

Renal pathologies (acute glomerulonephritis, parenchymal renal disease, and other kidney and urinary tract diseases) are the commonest aetiologies of hypertension identified by the respondents. This is like reports from other countries that identified secondary hypertension (SH) from underlying renal disease as the commonest cause in children.[18] Secondary hypertension, mostly from renal parenchymal disease, post-renal transplant aortic coarctation, and renovascular hypertension, was also the leading cause of hypertension in a cohort of 1452 children with hypertension studied by Obrycki et al in Europe.[19] Less than half of the cohort in the study (42.8%) had primary hypertension. A higher percentage of primary hypertension (59.1%) was, however, identified within the 13-18-year age group of the cohort. Riley et al similarly reported primary hypertension as overtaking secondary hypertension in the paediatric age group.[1] This may be a further insight that the prevalence of primary hypertension in children is on the increase, and Paediatricians should always consider this in their review of children with hypertension. A study by Bello et al identified unfamiliarity with essential hypertension in children among health care workers and recommended a review of the residency training curriculum and improvement in clinical skills to address this concern.[15]

About half of the respondents (46.6%) are aware of at least one hypertension management guideline, but only about three out of every five of these use any guideline. The most widely known and used guideline by the respondents is the American Academy of Paediatrics guideline. Only two respondents are aware of the Nigerian Hypertension Society (NHS) guideline, despite

it being published as early as 1996 and recently reviewed in 2020. There is thus a need for clinicians to be sensitized on the availability of such guidelines and to develop a native guideline for use in the management of hypertension in children in Nigeria.

The NHS recommends labetalol, alpha-methyldopa, hydralazine, and reserpine for the management of hypertensive emergencies and urgencies.[19] In the ESH guideline, labetalol, nicardipine, nitroglycerine, and nitroprusside are the first-line recommendations.[16] Both guidelines specifically discourage the use of sublingual nifedipine due to concerns about the unpredictability of blood pressure reduction and risk of sudden death. Among our respondents, hydralazine (44.9%) and labetalol (34.6%) were the most used antihypertensives for hypertensive emergencies, while calcium channel blockers (44.7%) were the most used in hypertensive urgencies. Calcium channel blockers are also the leading drugs for the routine management of hypertension. A major consideration in the NHS's recommendations is the availability of the drugs. This has also likely influenced our respondents' use of these antihypertensives in emergency settings. In addition, these guidelines mostly focus on hypertension in adults. There is a need to develop local guidelines on the management of hypertension with particular attention to children.

CONCLUSION

Our study has revealed the challenges faced with the assessment and diagnosis of hypertension in paediatric practice in Nigeria, the common causes among them, and how they are managed. It has also been identified that many Paediatricians who treat these children do not follow any guidelines in their management. Further education among Paediatricians in Nigeria is necessary to keep abreast of the latest treatment modalities. Facilities for measuring blood pressure across age groups should also be widely available.

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