

PREVALENCE OF BLOOD PRESSURE MEASUREMENT IN CHILDREN AT THE EMERGENCY DEPARTMENT OF IBN- ALATHEER PEDIATRIC TEACHING HOSPITAL IN MOSUL

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ABSTRACT

Background: Blood pressure measurement is an integral part of physical examination in children but it is not commonly done in children. Although blood pressure measurement in children in theory should be routine in practice, it is rarely done. With increasing incidence of childhood obesity and the knowledge that blood pressure level in childhood and adolescence are predictive of adult hypertension, routine blood pressure measurement in children should be considered. **Objectives:** To determine the prevalence of blood pressure measurement in children presenting to the emergency department of Ibn - Alatheer Pediatric Teaching Hospital in Mosul and to evaluate if there was recognition and follow up of prehypertensive and hypertensive cases. **Patients And Methods:** A prospective observational chart review study of 604 children of both gender, aged between <2 – 14 years presenting to the emergency department over a 6 months period from the 1st of October 2017 to the 1st of April 2018. The sample was a convenience sample that was randomly collected, including patients presented in the emergency department at different times of the day and different days of the week. Data are obtained from the records of the patients including (age, gender, presenting signs and symptoms), blood pressure chart, weight and height. Blood pressure is measured by auscultatory method using sphygmomanometer with different standard cuffs. The blood pressure is performed by a resident doctor present at the emergency department, and blood pressure plotted on blood Pressure percentile chart for age and sex is recommended by the second task force. **Results:** In total, 214 (35.4%) Patients had their blood pressure measured, 15 (7%) patients of them had blood pressure in the prehypertensive range ($\geq 90^{\text{th}}$ - < 95th percentile) with a lack of remeasurement and follow up, and 65 (30.4%) patients in the hypertensive range ($\geq 95^{\text{th}}$ percentile), only 34 (52.3%) from 65 patients had their blood pressure remeasured, 16 patients had persistent hypertension, from them only 4 patients had evaluation, treatment, and referred to the pediatric ward. Blood pressure was measured more frequently in patients aged >2 – 14 years (38% – 53.3%) and blood pressure was measured more frequently in higher triage category patients 100% and in renal diseases 71% (secondary hypertension). **Conclusion:** Our study demonstrates that blood pressure measurement in children at the emergency department was infrequent (35.4%) and inconsistent. Also there was a lack of follow up of prehypertensive and hypertensive cases.

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INTRODUCTION

Blood pressure (Bp) measurement is an integral part of physical examination in children (Bailey, 1993 and Frese, 2011). Many studies have shown that Bp levels tracks from infancy to early childhood pointing to important influences of

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future Bp levels which appear to be present even early in life (WBao, 1995; Chen, 2008; Redwine, 2012). With increasing incidence of childhood obesity, hypertension in children is now commonly observed and is known to be one of the most common causes of morbidity and mortality throughout the word (McCrindle, 2010 and Sanz, 2013), therefore evaluation of Bp and prevention of hypertension in children and adolescents has become a global priority issue in health

policies (Hosseini, 2010). Thus measurement of Bp is considered to be an integral part of routine physical examination in children, and should be interpreted according to the standard Bp nomograms recommended by the task force (Hosseini, 2010 and The fourth report on the diagnosis, evaluation, treatment of high blood pressure in children and adolescents pediatrics, 2004). Early studies of normal range Bp in children started in the end of 1970s (Foster, 1977) and since then, several reviews have been performed. The currently used references were developed by the National High Blood Pressure Education Program of The United States in 2004, establishing the 50th, 90th, 95th and 99th percentiles, according to age, sex, and height and defined hypertension as average systolic Bp (SBp) and/or diastolic Bp (DBp) \geq 95th percentile for age, sex and height on three occasions (The fourth report on the diagnosis, evaluation, treatment of high blood pressure in children and adolescents pediatrics, 2004).

Bp Classification / Interpretation (Apocket Guide to Blood Pressure Measurement in Children, 2007): BP is classified by systolic Bp (SBp) and diastolic Bp (DBp) percentiles for age / sex / height. If SBp or DBp $>$ 90th percentile, Bp should be repeated twice at same visit before interpreting result:

- Normal Bp: SBp or DBp $<$ 90th percentile.
- Prehypertension SBp or DBp \geq 90th percentile to $<$ 95th percentile or Bp $>$ 120 / 80 mm Hg to $<$ 95th percentile.
- Stage I Hypertension (HTN) SBp and/or DBp \geq 95th percentile to \leq 99th percentile plus 5mmHg.
- Stage II Hypertension SBp and / or DBp $>$ 99th percentile plus 5mmHg.

Systemic arterial hypertension with an estimated prevalence of 2 – 5% (Gregory, 2006; Falkner, 2010 and Flynn, 2017), is a common chronic diseases in children, hypertension in children may be secondary hypertension which is more common in children than in adults, and common causes of hypertension in children include (Renal, cardiac, central nervous system (C. N. S) and endocrine diseases) (Viera, 2010 and Gupta-Malhotra, 2015). Primary hypertension (essential hypertension) in which the cause is unknown, and is found to cluster in families and is associated with obesity, there is correlation with increase prevalence of hypertension with increase body mass index (Sorof, 2004 and Baker, 2007). Despite of current recommendations for routine Bp measurement in children from age 3years and above there is evidence that Bp measurement in children is not taken seriously (Gill, 2007), there is a lack of awareness of hypertension in children (Bernstein, 2007), with common belief that measurement of Bp in children is difficult and time consuming (Gill, 2007). Bp measurement in children presents a number of difficulties and variability and can be problematic, especially in the emergency department (ED) and the interpretation can be difficult because of pain and anxiety resulting in "white coat" hypertension (transient high Bp) (Martin, 2014) and gives false positive results. The accuracy of measuring Bp is affected by number of factors, including the equipment itself, observer skill, position of the arm, the mental status of the patient and the appropriate Bp cuff size (Gilman, 1995 and Moro-sutherland, 2008), so any abnormal high Bp should be remeasured, if still high requires follow up.

Aim of the study: To determine the prevalence of Bp measurement in children at the ED and to evaluate if there was recognition and follow up of prehypertensive and hypertensive cases.

PATIENTS AND METHODS

This was a prospective observational chart review study conducted at the (ED) of Ibn – Alatheer pediatric teaching hospital in Mosul over a six months period from the 1st of October 2017 to the 1st of April 2018. Our ED sees 25236-27200 cases per year and 2103 - 2266 cases per month. In total, 605 Patients of both gender, aged between $<$ 2 – 14 years were included in this study. The sample of patients was a convenience sample that was randomly collected at different times of the day and different days of the week. Data are obtained from the records of the Patients present in the ED including (age in years, gender, presenting symptoms and signs), physical examination (temperature C^o, pulse rate (beat/minute), respirator rate (breath/minute), blood pressure: systolic/diastolic mmHg, and anthropometric measurement (weight in Kg, and height in Cm). Bp was measured by auscultatory method using sphygmomanometer (mercury – gravity manometer with different standard cuffs (width \times length Cm) (4 \times 10 Cm), (9 \times 13Cm), and (13 \times 23Cm). Bp was performed by resident doctor present on shift at the ED, during primary assessment of the patients, and Bp was plotted on Bp percentiles chart for age, and sex, (recommended by the second task force on Bp control in children), with hypertension defined as SBp and/or DBp \geq 95th percentile. Data were also collected on cases had Bp remeasured and whether these cases had persistent high Bp and had follow up in the ED evaluation and treatment, and referred to the pediatric ward or had not.

RESULTS

604 patients were included in this study, age range between $<$ 2– 14 years, 334 (55.3%) were boys and 270(44.7%) were girls. Figure (1) shows percentage of cases with Bp measured from the total cases, 214 (35.4%) Patients from the total had their Bp measured, whereas 390 (64.6%) patients had not. Figure (2) shows percentage of high Bp cases from the measured cases.

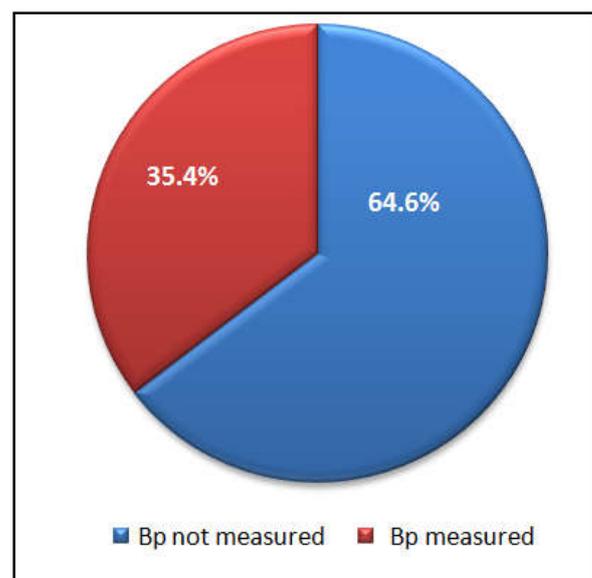


Figure 1. Percentage of cases with Bp measured from the total cases

In total, 134 (62.6%) Patients of the 214 had a normal Bp ($<$ 90th percentile), whereas 15 (7%) patients had Bp in the prehypertensive range (\geq 90th - $<$ 95th percentile), with a lack of

remeasurement and follow up of their Bp, and 65 (30.4%) patients had Bp in the hypertensive range ($\geq 95^{\text{th}}$ percentile). Out of 65 with abnormal Bp, 34 (52.3%) patients had their Bp remeasured of whom 18 patients had a normal Bp, of the 16 patients with two consecutive hypertensive reading, only 4 patients were evaluated and treated in the ED, then referred to the pediatric ward, the other 12 patients had no follow up organized (Figure 3).

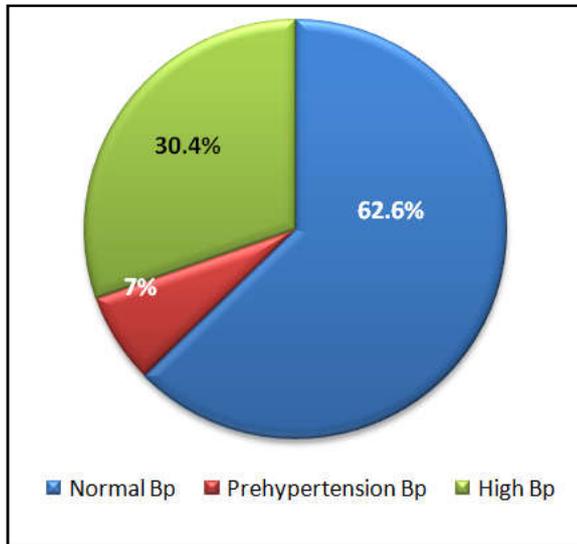


Figure 2. Percentage of high Bp cases from measured cases

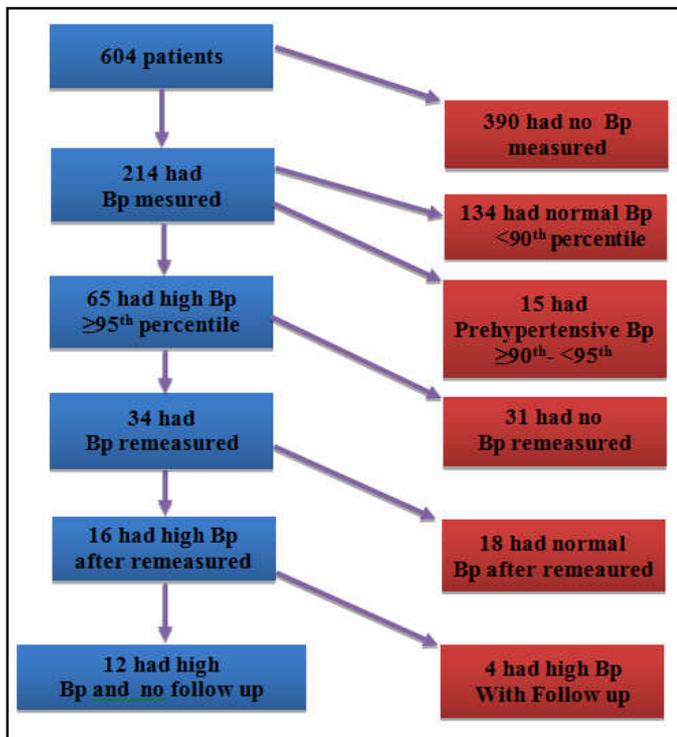


Figure 3. Summary of Bp measurement of all patients in the (present study)

Figure (4) shows frequency of Bp measurement by age, Bp measurement was more frequent in patients age above 2–14 years (38% - 53.3%), compared with Patients aged below 2years (8.3%). Figure(5)shows Frequency of Bp measurement by the American Triage scale level(1-5) , Bp measurement was more frequent in category (1) 100% this category being the (most urgent). The higher the triage category, the most likely

the resident doctor checked Bp. Table(1) shows the frequency of Bp measurement by diagnosis, Bp was more frequent in renal diseases 71%.

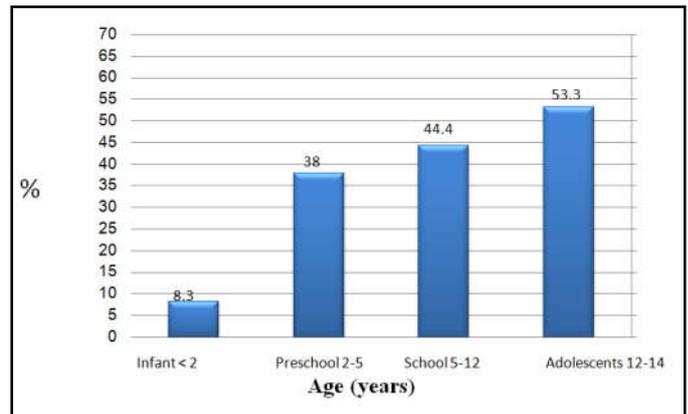


Figure 4. Frequency of blood pressure measurement by age

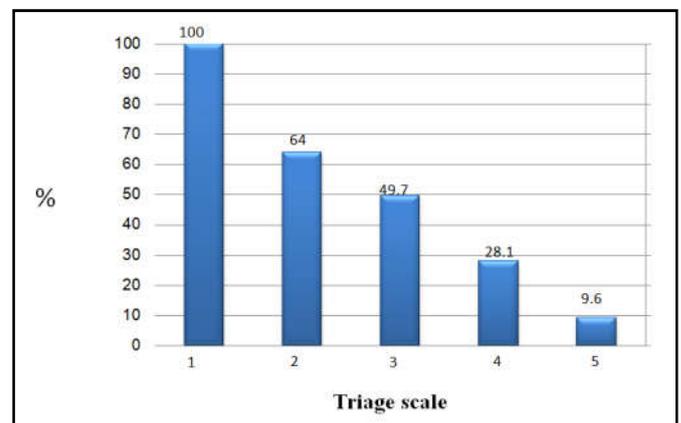


Figure 5. Frequency of blood pressure measurement by the American Triage scale

Table 1. Frequency of blood pressure measurement by diagnosis

| Diagnosing | No. Children | Bp measure | % |
|----------------------------|--------------|------------|------|
| Gastro intestinal diseases | 172 | 50 | 29 |
| Respiratory diseases | 163 | 29 | 17.8 |
| Renal diseases | 79 | 56 | 71 |
| Neurological diseases | 63 | 38 | 60.3 |
| Cardiac diseases | 49 | 29 | 59.2 |
| Infectious diseases | 27 | 1 | 3.7 |
| Blood diseases | 24 | 1 | 4.2 |
| Endocrine diseases | 18 | 8 | 44.4 |
| Anaphylaxis diseases | 5 | 1 | 20 |
| Orthopedic diseases | 4 | 1 | 25 |

DISCUSSION

BP measurement is an important physical examination in children and must be carried out at every medical examination regardless of the age range of the patient (Frese, 2011). This was the first study of prevalence of Bp measurements in children at an ED in Mosul. The present study confirms that Bp measurement in our department was performed in a minority of patients (35.4%) and Bp measurement in our ED was inconsistent, this is evidenced by the number of Patients not having their Bp measured (64.6%). The present study also confirms that there was a significant association between frequency of Bp measurement with age of the Patients , Bp was measured more frequently in patients aged over 2 – 14 years (38% - 53.3%) compared with patients aged below 2

years 8.3%. In 2000, Silverman et al retrospectively reviewed 437 charts of patients presenting to four EDs in the USA, the results were 294 (67.3%) had triage Bp record. Bp was measured more frequently in adolescents (93%), than that in infants (35%) (Silverman, 2000). In 2006 Gilhotra and Willis (Western Australia), prospectively reviewed 504 charts of patients presenting in the ED of BC children's hospital they found that Bp was measured only in 114 (22.6%) patients, the frequency of Bp measurement increased with age from 7.8% in patient less than one year to 60.8% for children aged 10 year and older (Gilhotra, 2006). Both studies support our finding that Bp is not measured in all children presenting at the ED and that Patients age correlates with likelihood of Bp measurement. Regarding the severity of the illness, our data confirms that a higher triage category (triage1) the (most urgent one), increases likelihood of Bp measurement independent of presenting symptoms. The present study also confirms that Bp measurement was found to be more frequent in patients with renal diseases (71.1%). This points out how many hypertensive cases could be missed if we keep in mind only secondary hypertension as an indication for measuring Bp in children, thus there will be under diagnosis of asymptomatic hypertension. The study also confirms that 15 (7%) patients of 214 had their Bp in the prehypertensive range, with a lack of remeasurement and follow up of their Bp this group will be at risk because prehypertension is considered to be an indication of heightened risk for developing hypertension (McNiece, 2007). The number of children in the hypertensive range was 65 (30.4%), 31 (47.7%) had a single measured ($\geq 95^{\text{th}}$ percentile) not having their Bp remeasured, and by a lack of follow up of children with persistently high Bp (7.5%), (had a Bp reading above the 95^{th} percentile on repeated measurement) in the ED. Only 4 patients of 16 with two consecutive hypertensive readings were evaluated, treated and then referred to the pediatric ward. In light of the finding there was lack of follow up of prehypertensive and hypertensive cases and Bp measurement is yet to be incorporated to the routine clinical assessment. In our ED Bp was measured in a selected cases. There are guidelines for which children should have Bp measured as a part of routine clinical examination. Some Categories of illness Bp measurement is mandatory such as, neurological diseases, cardiac diseases and renal diseases. The study confirms that these guidelines are not adhered to. Despite guidelines recommendation about important of Bp measurement in children, Bp measurement it is still performed somewhat randomly in our ED leading to inconsistencies. In this study we are reviewing the policy of Bp measurement in our ED. There is no doubt that Bp measurement in children presents a number of difficulties and variability of Bp greater than adults, children in the ED often presenting with problem including anxiety, fear and pain. So ensure the child is comfortable, cooperative and if possible not crying with several measurements of Bp. This is difficult somewhat in the ED. However measurement of Bp in children merely requires patience, practice and using appropriate equipment and appropriate cuff size and good training medical staffs

The present study reviews the current practice of Bp measurements in children presenting to an ED. As a convenience sample was used, randomly collected. The sample might not be representative of all children presenting at the ED. In addition, this was a single - site study and the finding might not be representative of other EDs. As Bp was measured by a number of different resident doctors present at the ED (on shift), the accuracy of the measurement might not be precise, choice of cuff size can alter reading significantly. If

the cuff is too small, gives false high Bp and a large cuff size could produce a false low Bp reading. The update on the task force includes height as well as age and sex for the Bp nomograms. This is a more accurate for Bp in childhood as it incorporate body size but was not feasible for our study, because height is not routinely measured in our ED, therefore we used normogram from the second Task Force based on age and sex (Ingelfinger, 2004). Recently, a fourth task force report on Bp in children was presented to the American Society of Hypertension. The working group recommended that Bp should be measured routinely in all children older than 3 years of age (McNiece, 2007 and Ingelfinger, 2004). Thus, all such children should have their Bp measured in the ED. Unlike adults this could be time – consuming, especially when faced with uncooperative or crying children making the whole process of limited clinical value (Moro-sutherland, 2008). Once a high Bp is measured, a repeated reading must be performed. If the second reading is still high, follow up needs to be organized either through a general practitioner or a pediatrician. This could lead to increased strain on resources and possibly unnecessary investigations. It might be that one of our roles as Pediatricians working in the ED, health center, hospital and other health settings, to identify these children with high Bp and to ensure that these children receive followed up. If staff perform Bp measurements on all patients and they become familiar with reference ranges, more children can be appropriately follow up. This will lead to early catch up those at risk and abort high Bp in it is early stages before symptoms started. Lastly, greater attention to Bp early in life might ultimately lead to considerable improvement in cardiovascular health (Viera, 2010). A specific research in the field of Bp control in Iraqi children should be encouraged and founded. For this purpose, guideline for research in children should be developed including the evaluation of new drugs and other methods of Bp control.

Conclusion

Despite of Pediatrician consensus statements and guidelines recommendation about importance of Bp measurement in children ≥ 3 years in every physical examination, our study demonstrates that Bp measurement in children at the ED was infrequent (35.4%), inconsistent and there was a lack of follow up of abnormal Bp (prehypertension and hypertension). Further research is required to determine the usefulness and feasibility of routine Bp measurements in children presenting to the ED and those admitted to the hospital. This might improve the quality of health care and positively impact on public health for the future. Finely hypertension as a chronic disease may affect the child and his family in many ways, also may raise a number of questions about which we are still ignorant, the detection and study of hypertension in children is therefore an important task and a challenge for doctors, especially those who work in pediatric field.

Recommendation

- Bp should be measured for every patient presented to the ED or admitted to the hospital and in every visit to the health center ≥ 3 year of age according to the recommendation of the fourth task force in Bp control in children.
- Physicians, residents, training doctors even nurses should be acquainted with the physiological basis of the

systemic Bp and should keep in mind the variable that affect the accurate measurement of Bp .

- Especial Bp percentile chart for age, sex and height (Bp nomograms) is recommended by the Task Force in Bp control in children, to be used, in every health centers, intensive care unit (I. C. U), ED and pediatric ward by medical staff.

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