Management of Patients with Severe Hypertension in Emergency Department, Maharaj Nakorn Chiang Mai Hospital

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Background: *Management of patients with severe hypertension without progressive target organ damage remains controversial. Some guidelines mentioned oral anti-hypertensive medication as a treatment to reduce blood pressure in the emergency department, while others recommended against such treatment.*
Objective: *To review the management of patients with severe hypertension without progressive target organ damage in the emergency department, Maharaj Nakorn Chiang Mai hospital.*
Material and Method: *In a retrospective descriptive analysis study, medical records of adult patients diagnosed with severe hypertension without progressive target organ damage between January 2011 and December 2012 were reviewed. Patient demographics, data on management including investigation sent and treatment given were collected. Statistical analysis was done by using descriptive statistics and Kruskal-Wallis one-way analysis of variance test.*
Results: *One hundred fifty one medical records were reviewed. Four oral anti-hypertensive medication were used to reduce blood pressure, Amlodipine, Captopril, Hydralazine, and Nifedipine. There were no significant difference between each medication in terms of their effect on blood pressure reduction ($p = 0.513$). No side effect or other complications from the use of oral anti-hypertensive medication were recorded.*
Conclusion: *The choice of medication used for the treatment of hypertensive urgency ranged from Amlodipine, Captopril, Hydralazine, and Nifedipine, which varied in dosage. However, their efficacies were the same when compared with each other, and none produced any notable side effects.*

Keywords: *Hypertensive urgency; Antihypertensive agents*

J Med Assoc Thai 2014; 97 (9): 917-22
Full text. e-Journal: *http://www.jmatonline.com*

Hypertension is a common condition seen in everyday practice. In Thailand, there were over 11 million patients diagnosed with hypertension[1] and data showed over 600,000 new cases in the year 2012[2]. Patients with elevated blood pressure in the emergency department are categorized into "hypertensive emergency" patients if they were found to have progressive target organ damage, such as, stroke, myocardial infarction, aortic dissection, or heart failure; "hypertensive urgency" patients if no severe symptoms or progressive end-organ damage were found and no prior history of hypertension were recorded, and "uncontrolled severe hypertension" if they had prior history of hypertension but no progressive target organ damage were found on this visit[3].

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There is no current universal guideline to guide the detection of progressive target organ damage in patients with elevated blood pressure in the emergency department. One article suggested a fundoscopic examination, heart auscultation, abdominal examination, palpation of peripheral pulses and complete neurological examination, along with clinical laboratory testing of electrolytes, glucose, urea, creatinine, urine analysis, complete blood count, electrocardiogram and chest radiography[4]. However, as these tests tend to be within normal limit, investigations sent in these cases depend mainly on the physician's judgment.

Reduction of blood pressure in patients diagnosed with severe hypertension without progressive target organ damage remains controversial. The American College of Emergency Physician (ACEP) suggested against treatment of asymptomatic hypertension in the emergency department when patients have follow-up, but if treatment was initiated, blood pressure should not be expected to be normal

during the visit[5]. Treatment for severe hypertension without progressive target organ damage suggested in most literatures was oral anti-hypertensive medications. Clonidine, Labetalol and Captopril were mentioned in the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC 7 Report)[6], while Nifedipine, Lacidipine, Uradipil, Fenoldopam, Furosemide, Propranolol and Losartan were also mentioned in other literatures[3,7,8]. Nevertheless, newer guidelines do not mention any suggestion on treatment of severe hypertension without progressive target organ damage[9,10]. Clinical practice guideline on management of patients with severe hypertension without progressive target organ damage has yet to be made and many studies are being carried out to observe the effect of the use of oral anti-hypertensive drugs in this situation.

The objective of the present study was to review the management of patients with severe hypertension without progressive target organ damage in the emergency department, Maharaj Nakorn Chiang Mai Hospital, along with the choice of oral anti-hypertensive medication used for the treatment and their side effects.

Material and Method

The present study was a retrospective descriptive analysis study. Medical records of patients attended emergency department, Maharaj Nakorn Chiang Mai Hospital, with elevated blood pressure between January 2011 and December 2012 were reviewed. Adult patients age ≥18 years diagnosed with severe hypertension without progressive target organ damage, and was given any kind of oral antihypertensive drug at the emergency department were enrolled into the study. Severe hypertension was defined as a systolic blood pressure (SBP) of more than 180 mmHg and/or diastolic blood pressure (DBP) of more than 120 mmHg[3]. Patients diagnosed with hypertensive emergency and pregnancy-induced hypertension were excluded from the study.

Data collection included the patient's sex, age, underlying disease, presenting symptoms, SBP, DBP, calculated mean arterial pressure (MAP), physical examination recorded by the medical student or physician, investigation and/or imaging done before the treatment. The choice and dosage of oral anti-hypertensive medication given was also recorded. SBP and DBP were then measured after the initial treatment. According to the onset of action, the authors selected the patient's recorded SBP and DBP at 30 minutes if the patient was treated with Captopril, Hydralazine, or Nifedipine, and 60 minutes if the patient was treated with Amlodipine. MAP was then calculated and compared to the initial calculated MAP. The side effects of the medication encountered, whether or not the patient needed another dosage of oral anti-hypertensive medication, follow-up arrangement after discharge and home medication for further treatment of hypertension were also recorded.

Descriptive statistics was used to describe basic characteristics. Data were displayed as frequency, percentage, mean, standard deviation (SD), median and interquartile range (IQR). Comparison between each oral anti-hypertensive drug was done by using Kruskal-Wallis one-way analysis of variance test. Data analysis was done by using SPSS version 10. A p-value of less than 0.05 was considered statistically significant.

The present study was considered and approved by the Hospital's Ethic Committee.

Results

One hundred fifty one patients were diagnosed with severe hypertension without progressive target organ damage and were treated with oral anti-hypertensive medications in the study period. Sixty-five (43%) were male and mean age was 56.5 years old. The most common presenting symptoms were headache (26.5%) and dizziness (21.8%), while 49 patients (32.4%) had no presenting symptoms. One hundred seven patients (70.9%) had base line diagnosis of hypertension, however, 28 patients (26.2%) were found to be non-compliant. The most common medication used by the patients enrolled into the study were beta blockers (14.6%), calcium channel blockers (11.9%), and angiotensin-converting enzyme inhibitors (ACEIs) (11.9%), with many patients using more than one medication. Other underlying disease included dyslipidemia (23.8%), diabetes mellitus (19.2%), other rheumatologic diseases (11.2%), with some patients had more than one disease, while twenty-six patients (17.2%) had no previous medical illness prior to the visit. Before initiated treatment, the mean SBP was 210.6 mmHg, mean DBP was 113.8 mmHg, and mean calculated MAP was 146.1 mmHg. Characteristic of patients enrolled were shown in Table 1.

Physical examination recorded by medical students or physicians included heart examination (96%), abdominal examination (96%), and neurological examination (78.1%). However, abdominal bruit, fundoscopic examination, and palpation of peripheral pulses were included in 13.2%, 9.9%, and 3.3%,

Table 1. Characteristic of patient enrolled into the study

Characteristics	n = 151
Age (years), (mean±SD)	56.5±15.7
Sex	
Male	65 (43.0%)
Female	86 (57.0%)
Underlying disease*	
Hypertension	107 (70.9%)
Dyslipidemia	36 (23.8%)
Diabetes mellitus	29 (19.2%)
Rheumatologic diseases	17 (11.2%)
Cardiovascular diseases	12 (7.9%)
Other	27 (17.9%)
No previous medical illness	26 (17.2%)
Chief complaint	
None	49 (32.4%)
Headache	40 (26.5%)
Dizziness	33 (21.8%)
Pain	5 (3.3%)
Other	24 (16.0%)
Oral anti-hypertensive used prior to this visit**	
None	55 (36.4%)
Non-compliance	28 (18.5%)
Beta blockers	22 (14.6%)
ACEIs	18 (11.9%)
Calcium channel blockers	18 (11.9%)
ARBs	13 (8.6%)
Others	17 (11.2%)

ACEIs = angiotensin-converting enzyme inhibitor; ARBs = angiotensin II receptor blockers
* One patient could have one or more underlying disease
** One patient could be using one or more oral anti-hypertensive medication

respectively. Other investigation and/or imaging sent were electrocardiogram, Creatinine, chest radiography, and urine analysis in 88.1%, 86.1%, 68.2%, and 63.6%, respectively. All electrocardiograms, chest radiography and urine analysis demonstrated no evidence of target organ damage. Mean creatinine level was 0.9 mg/dl (70.7 µmol/L). Data were shown in Table 2.

There were four oral anti-hypertensive medication used to reduce the blood pressure, Amlodipine, Captopril, Hydralazine, and Nifedipine. The most frequently used medication was Captopril (53%), Amlodipine (31.1%), Hydralazine (12.6%), and Nifedipine (3.3%), respectively. Median reduction of the patient's MAP was found greatest when using Nifedipine 10 mg (28.7 mmHg), however, when compared between each medication using Kruskal-Wallis one-way analysis of variance test, there were no significant difference between each medication (p = 0.513). The medication that had the highest rate of needed second dose were Captopril 6.25 mg (50%), Hydralazine 25 mg (47.4%), and Amlodipine 10 mg (38.9%). All cases treated with Nifedipine 10 mg required no further use of a second dose. Data were shown in Table 3.

One hundred forty five patients (96%) had evidence of medication initiation or adjustment at discharge, 146 patients (96.7%) had scheduled for follow-up, and 129 patients (85.4%) were presented at follow-up. No side effect or other complications from the use of oral anti-hypertensive medication in reducing the patient's blood pressure at the emergency department were recorded.

Discussion

Patients with asymptomatic elevated blood pressure can be found in routine work in the emergency department. The authors found that some of these patients had lower readings of their blood pressure on

Table 2. Physical examination and investigation sent to determine absence of target organ damage

Physical examination/investigation	n = 151
Physical examination	
Cardiac auscultation	145 (96.0%)
Abdominal examination	145 (96.0%)
Neurological examination	118 (78.1%)
Abdominal bruit detection	20 (13.2%)
Fundoscopic examination	15 (9.9%)
Palpation of peripheral pulses	5 (3.3%)
Investigation	
Electrocardiogram	133 (88.1%)
Creatinine	130 (86.1%)
Chest radiography	103 (68.2%)
Urine examination	96 (63.6%)
Creatinine level (mg/dl, µmol/L), (median (P25, P75))	0.9 (0.7, 1.3), 70.7 (53, 106.1)

Table 3. Efficacy of oral anti-hypertensive medication treatment

Medication	Dosage (mg)	n	MAP (mmHg)		Median of reduction of MAP* (P25, P75) (mmHg)	Number of cases who require second dose of medication
			Before treatment	After treatment		
Amlodipine	5.00	11	140.1	103.0	23.0 (14.7, 30.0)	2 (18.2%)
Amlodipine	10.00	36	147.6	131.3	17.8 (5.6, 28.2)	14 (38.9%)
Captopril	6.25	2	136.7	122.2	14.5 (9.0, 20.0)	1 (50.0%)
Captopril	12.50	58	145.5	125.8	18.3 (7.2, 30.7)	18 (31.0%)
Captopril	25.00	20	148.3	124.4	19.8 (15.0, 34.8)	6 (30.0%)
Hydralazine	25.00	19	144.2	126.2	19.0 (10.3, 29.7)	9 (47.4%)
Nifedipine	10.00	5	155.0	122.9	28.7 (18.3, 47.5)	0 (0%)
					$p = 0.513$	

MAP = mean arterial pressure
* Calculated from median of difference of MAP measured before and after treatment of each patient in the group

the subsequent measurement without any treatment, while a small number of patients had remaining elevated blood pressure without any complaint or symptoms. This supports that a single elevated blood pressure reading is not sufficient[12], and a blood pressure monitoring may be needed in this group of patients. Likewise, the use of only one set of blood pressure in the present study can be inaccurate. However, this was limited by the retrospective design itself in which blood pressure was recorded at arrival and after treatment with oral anti-hypertensive medication. A well-designed protocol prospective study may improve the accuracy of blood pressure measurement.

Although most of the patients enrolled into the study had a baseline diagnosis of hypertension, there were 17.2% who had no known previous medical illness prior to the visit. In the present group of patient, the diagnosis of hypertension can be made and treatment should be initiated according to the Eight Joint National Committee guideline[9]. Therefore, the physician working in the emergency department may also play a role in long-term treatment of hypertension, although there are no current data to confirm that the role will improve the patient's outcome[13]. Data on time since diagnosis of hypertension or time since initiation of treatment with oral anti-hypertensive medication were not obtainable through the medical record alone; therefore, further studies need to be carried out to determine its significance.

Physical examination recorded in the medical record was found to be incomplete. Fundoscopic examination was recorded in only 9.9%. This might be due to the brightness of the setting of the emergency department, which was not suitable to perform the examination. The authors also found inconsistency in the investigation and imaging sent in order to determine absence of end-organ damage. This might be due to the physician's judgment and the patient's prior investigation history. A protocol for standardized investigation should be set up, and a cost-analysis study should be carried out to define the cost-effectiveness of these investigations.

Management of severe hypertension without progressive target organ damage in Thailand tends toward treatment with oral anti-hypertensive medication, although not recommended or not mentioned in many guidelines[5,9,10]. There is no consensus on which investigation to be sent, which medication to be used, what the targeted blood pressure should be, or when to discharge the patient home. However, data from the present study demonstrated that using Amlodipine, Captopril, Hydralazine, and Nifedipine was equally effective to lower the blood pressure before discharge. Moreover, since no side effect was found during the visit and on follow-up, treatment of severe hypertension without progressive target organ damage with oral anti-hypertensive medication in the emergency department may be safe.

Conclusion

Physical examination and investigation sent in order to determine absence of target organ damage were inconsistent among patients. The choice of medication used for the treatment of severe hypertension without progressive target organ damage ranged from Amlodipine, Captopril, Hydralazine and Nifedipine,

which varied in dosage. However, their efficacy was the same when compared with each other, and none produced any notable side effects.

What is already known on this topic?

Patients with elevated blood pressure in the emergency department should be investigated to determine whether they had target organ damage. Without any target organ damage, a diagnosis of hypertensive urgency or uncontrolled severe hypertension is made and treatment with oral anti-hypertensive drug is an option. Some suggested an adjustment of medication and discharge without any treatment in the emergency department.

What this study adds?

The use of Amlodipine, Captopril, Hydralazine, and Nifedipine to reduce the blood pressure in patients with severe hypertension without progressive target organ damage in the emergency department setting may be safe and effective.

Potential conflicts of interest

None.

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การศึกษาทบทวนการดูแลผู้ป่วยความดันโลหิตสูงเร่งด่วนในห้องฉุกเฉิน

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ภูมิหลัง: การดูแลรักษาผู้ป่วยความดันโลหิตสูงเร่งด่วนในห้องฉุกเฉินยังไม่มีแนวทางปฏิบัติที่ชัดเจน เนื่องจากยังไม่มีหลักฐานว่าควรรีบลดความดันโลหิตลงในห้องฉุกเฉินหรือไม่ บางแนวทางปฏิบัติแนะนำการให้ยาลดความดันโลหิตแบบรับประทานเพื่อลดความดันโลหิตได้ ในขณะที่บางแนวทางปฏิบัติไม่แนะนำการให้ยาในห้องฉุกเฉิน

วัตถุประสงค์: เพื่อศึกษาทบทวนการดูแลผู้ป่วยความดันโลหิตสูงเร่งด่วนในห้องฉุกเฉิน โรงพยาบาลมหาราชนครเชียงใหม่

วัสดุและวิธีการ: การศึกษาเป็นแบบ retrospective descriptive analysis study เก็บข้อมูลจากประวัติการรักษาของผู้ป่วยผู้ใหญ่ที่เข้ารับการรักษาในห้องฉุกเฉินและได้รับการวินิจฉัยว่าเป็นความดันโลหิตสูงเร่งด่วน ระหว่างวันที่ 1 มกราคม พ.ศ. 2554 ถึง 31 ธันวาคม พ.ศ. 2555 โดยเก็บข้อมูลเบื้องต้นเกี่ยวกับผู้ป่วย การตรวจวินิจฉัย และการรักษา วิเคราะห์ข้อมูลโดยแสดงเป็นสถิติเชิงพรรณนา ร่วมกับการคำนวณโดยใช้การทดสอบทางสถิติแบบ Kruskal-Wallis one-way analysis of variance ในการเปรียบเทียบระหว่างการรักษาด้วยยาแต่ละชนิด

ผลการศึกษา: ข้อมูลจากประวัติการรักษาของผู้ป่วยทั้งหมด 151 ราย มีการรักษาด้วยยาลดความดันโลหิตแบบรับประทานทั้งสิ้น 4 ชนิด ได้แก่ amlodipine, captopril, hydralazine และ nifedipine ไม่พบความแตกต่างของประสิทธิภาพในการลดความดันโลหิตของยาทั้ง 4 ชนิด ($p = 0.513$) และไม่พบผลข้างเคียงจากการใช้ยาลดความดันโลหิตในการรักษาผู้ป่วย

สรุป: ยา amlodipine, captopril, hydralazine และ nifedipine ถูกเลือกใช้เพื่อลดความดันโลหิตในผู้ป่วยที่ได้รับการวินิจฉัยว่าเป็นความดันโลหิตสูงแบบเร่งด่วนในห้องฉุกเฉิน โดยยาทั้ง 4 ชนิด ให้ผลไม่แตกต่างกันอย่างมีนัยสำคัญทางสถิติ และไม่พบผลข้างเคียงจากการใช้ยา