


## REVIEW

# Hypertensive emergencies in Asia: A brief review

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**Abstract**

Hypertensive emergency is one of the most challenging conditions to treat in the emergency department (ED). From previous studies, about 1%–3% of hypertensive individuals experienced hypertensive emergencies. Its prevalence varied by country and region throughout Asia. Asian populations have more different biological and cultural backgrounds than Caucasians and even within Asian countries. However, there is a scarcity of research on clinical features, treatment, and outcomes in multinational Asian populations. The authors aimed to review the current evidence

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about epidemiology, clinical characteristics and outcomes, and practice guidelines in Asia.

Five observational studies and nine clinical practice guidelines across Asia were reviewed. The prevalence of hypertensive emergencies ranged from .1% to 1.5%. Stroke was the most common target organ involvement in Asians who presented with hypertensive emergencies. Although most hypertensive emergency patients required hospitalization, the mortality rate was low. Given the current lack of data among Asian countries, a multinational data repository and Asian guidelines on hypertensive emergency management are mandatory.

#### KEYWORDS

Asia, emergency, hypertension, hypertensive crisis

## 1 | INTRODUCTION

A hypertensive emergency can be fatal, and it is one of the most challenging conditions to treat in the emergency department (ED).<sup>1</sup> Patient with uncontrolled hypertension can develop a hypertensive crisis, generally classified as hypertensive emergency or hypertensive urgency.<sup>2</sup> Hypertensive emergencies are more critical since the condition is associated with acute vital organ damage such as stroke, acute heart failure (AHF), acute coronary syndromes (ACS), and acute aortic dissection (AAD).<sup>2-4</sup>

Globally, it has been reported that around 1%–3% of hypertensive patients experience hypertensive emergencies.<sup>5</sup> In Asia, the prevalence of hypertensive emergencies varied among countries and regions and was lower than that in Western countries.<sup>6-10</sup> However, despite a relatively small number of patients, hypertensive emergencies are potentially fatal in clinical practice. According to recent evidence, the in-hospital mortality rate was around 2.5%.<sup>5</sup> Still, with early detection and treatment of hypertensive emergencies, fatal organ involvement can be mitigated, and morbidity and mortality due to hypertensive emergencies can be prevented.<sup>2,8,11</sup>

Asian populations have a wide range of biological and cultural backgrounds. These differences may have an impact on the prevalence, clinical presentation, treatment, and outcomes of hypertensive emergencies in Asians. Observational studies and clinical practice guidelines were conducted in some Asian countries. However, there is a lack of a uniform review and integration of information from existing evidence. We aimed to review the current information about hypertensive emergency epidemiology, clinical characteristics and outcomes, and practice guidelines in Asia.

## 2 | SEARCH STRATEGY

This review considered epidemiological study designs including prospective and retrospective cohort studies and national guidelines. To identify relevant Review Papers regarding “hypertensive

emergency” and “Asia/Asian,” a comprehensive search for Review Papers published within the last 20 years (2002–2022) in PubMed, Google Scholars, and the Cochrane Library was conducted. The keywords included hypertensive crisis/crises, hypertensive emergency/emergencies, target organ damage (TOD), hypertensive urgency, Asia, Asian, and guidelines used in various combinations. Full papers and abstracts published in English and non-English languages were reviewed. Furthermore, we searched through all the references in the primary Review Papers for relevant sources of information. Aside from the databases already mentioned, well-selected data from national statistics and practice guidelines were examined (Figure 1).

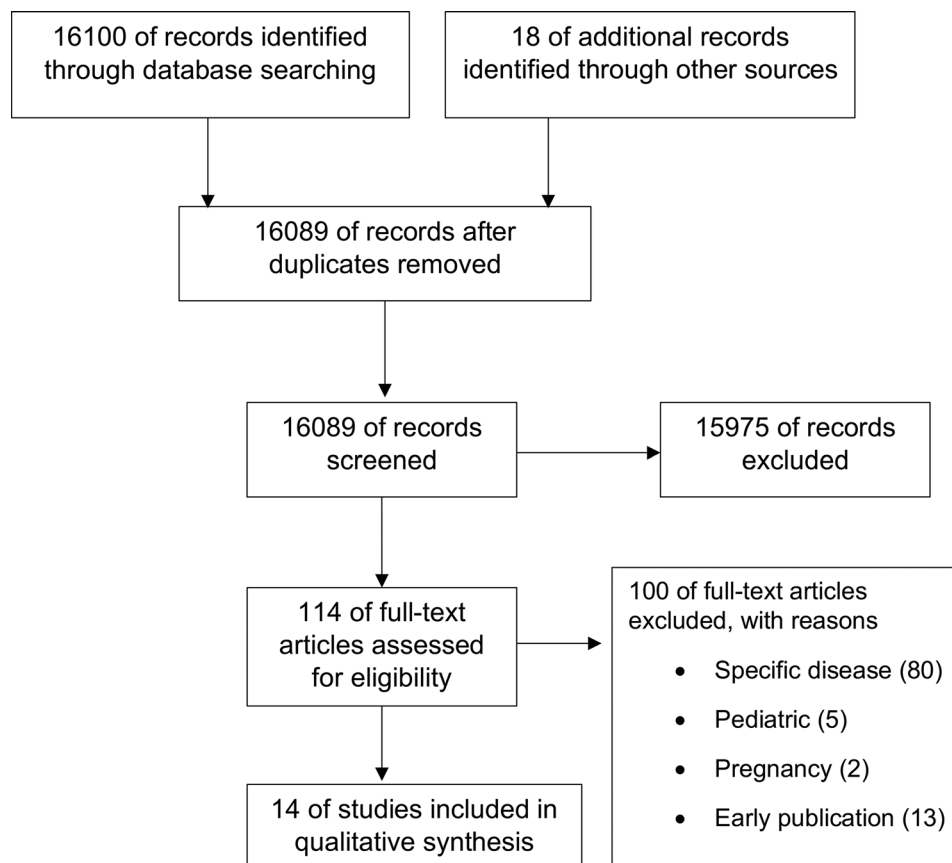
## 3 | RESULTS

There were five observational studies<sup>6-10</sup> (Table 1) and nine clinical practice guidelines<sup>12-20</sup> (Table 2) included in this review based on the hypertensive emergencies data we attempted to identify, including epidemiology, clinical characteristics, treatment recommendations, and outcomes of hypertensive emergencies in Asian populations.

Most studies in Asia and national practice guidelines<sup>12-20</sup> employed a set of criteria to diagnose hypertensive crisis that was aligned with the 2018 European Society of Cardiology/European Society of Hypertension Guidelines for the management of arterial hypertension<sup>21</sup> and the 2017 hypertension guidelines of the American College of Cardiology/American Heart Association's definition.<sup>3</sup> Hypertensive crisis was defined by systolic blood pressure (SBP)  $\geq$  180 mmHg and/or diastolic blood pressure (DBP)  $\geq$  120 mmHg. However, the hypertensive emergency was primarily defined based on the presence of acute TOD, including stroke, ACS, AHF, intracerebral hemorrhage (ICH), hypertensive encephalopathy, AAD, or acute kidney injury (AKI), even in cases where blood pressure may be lower than 180/120 mmHg.

### 3.1 | Epidemiology

From cross-sectional and retrospective studies across South and Southeast Asia, the prevalence rate of hypertensive emergency in



**FIGURE 1** Study search and selection flow. A total of 16 118 titles were primarily retrieved from several databases and additional sources. After duplicates were removed, 16 089 studies were screened by title and abstract for eligibility. Of the remaining Review Papers, 114 full-text Review Papers were retrieved, and each was assessed for eligibility. One hundred Review Papers were excluded for various reasons, including hypertensive emergencies in patients with specific conditions, such as cancer, advanced age, obstructive sleep apnea, hypertensive emergencies in children, and pregnant women. Furthermore, studies that were not published during the chosen time period were excluded.

the ED was around .1–.5%.<sup>6–10</sup> However, from the National Emergency Department Information System (NEDIS) database of Korea,<sup>7</sup> the prevalence rate of hypertensive emergency was three times higher than the prevalence rate of the study in the Thai population<sup>6</sup> during the same period (1.46% vs. .51%; Table 1). A study of patients admitted to the intensive care unit (ICU) in India found that 1.22% of the patients had a hypertensive emergency.<sup>10</sup> (Table 1)

### 3.2 | Presenting symptoms and target organ damage

Dyspnea was one of the most prevalent symptoms reported across all studies, with varying prevalence levels from 10% to 30%.<sup>6–10</sup> In the study from Pakistan, the most prevalent presenting symptom was headache,<sup>8</sup> whereas, in Thais and Indonesians, the most common symptom of the presentation was neurological impairment, for example, hemiparesis.<sup>6,9</sup> In contrast to other countries, chest pain was the most common presenting symptom among Koreans.<sup>7</sup> (Table 1)

Mean SBP/DBP at presentation was highest in the study from Indonesia ( $220\pm 21/119\pm 24$  mmHg).<sup>9</sup> Mean SBP/DBP in the stud-

ies from Pakistan<sup>8</sup> and Thailand<sup>6</sup> were  $202\pm 18/108\pm 17$  mmHg and  $199\pm 20/105\pm 20$  mmHg, respectively. However, the study in Koreans showed the lowest initial SBP and DBP with a median of 188 (172–206) and 105 (99–115) mmHg.<sup>7</sup>

Most hypertensive emergency patients admitted to the ED suffered from stroke; 57.6% in Indonesians,<sup>9</sup> 49.8% in Thais,<sup>6</sup> and 43% in Koreans.<sup>7</sup> However, in the study from Pakistan,<sup>8</sup> the most common TOD was AKI (41.3%), followed by ACS (28.8%), AHF (18.3%), and stroke (6.5%). (Table 1) AKI was the second most common TOD in Indonesians<sup>9</sup> (30.8%), while the second most common organ involvement in Thais<sup>6</sup> and Koreans<sup>7</sup> was heart disease (ACS and AHF) (Table 1).

### 3.3 | Management

The management discussed in this review was solely based on the guidelines' recommendations. The national practice guidelines for hypertension in China, South Korea, Japan, India, Pakistan, Malaysia, Indonesia, Vietnam, and Thailand discussed the management of hypertensive emergencies under the specific population section.<sup>12–20</sup> Each

**TABLE 1** Studies of hypertensive emergency patients, categorized by country

| Country/Year of data collection | Authors/Year of publication    | Research design                           | Type/Level of medical service | Inclusion criteria                  | N      | Prevalence of HTE <sup>3</sup> | Mean age <sup>b</sup>  | Sex, women (%)  | Mean±SD SBP (mmHg) <sup>b</sup> | Known HT (%) | Presenting symptoms (%)  | TOD (%)  | Outcome (%)   |
|---------------------------------|--------------------------------|---|-------------------------------|-------------------------------------|--------|--------------------------------|------------------------|-----------------|---------------------------------|--------------|--|--|---|
| Pakistan, 2005–2010             | Alms and colleagues, 2014      | Cross-sectional study                     | ED/Tertiary-care center       | Patients > 18 yr, known HT cases    | 73 063 | .14% (n = 104)                 | 55.9±15.1 <sup>c</sup> | 59 <sup>c</sup> | 202±18 <sup>c</sup>             | 100          | Headache (35.7), Dyspnea (32.6), Chest pain (21.4)                 | AKI (41.3), ACS (28.8), AHF (18.3), Stroke (6.5) | NA  |
| Indonesia, 2014–2015            | Lugito and colleagues, 2016    | Retrospective study                       | ED/Secondary-care center      | Patients > 18 yr                    | 20 435 | .12% (n = 26)                  | 52.8±12.8              | 57.7            | 220±21                          | 84.6         | Hemiparesis (46), Dyspnea (31)                                     | Stroke (57.6), AKI (30.8)                        | NA  |
| India, 2011–2013                | Dhadke and colleagues, 2017    | Cross-sectional study                     | ICU/Tertiary-care center      | Patients > 18 yr, BP > 180/120 mmHg | NA     | 1.22% <sup>d</sup> (n = 50)    |                        |                 |                                 |              | Dyspnea (34), Neurological deficits (28), headache (26)            |  | NA  |
| Thailand, 2016–2019             | Kotruchin and colleagues, 2020 | Retrospective cohort study                | ED/Tertiary-care center       | Patients > 18 yr, BP > 140/90 mmHg  | 60 755 | .51% (n = 1342)                | 65.9±13.6              | 47.9            | 199±20                          | 63.7         | Limb weakness (24.5), Dyspnea (10.8), Impaired consciousness (8.8) | Stroke (49.8), AHF (19.3), ACS (6.5)             | Admission (78.9), Discharge to home (13.6), Refer to other hospital (6.7), Dead (1) |
| Korea, 2016–2019                | Kim and colleagues, 2021       | Cross-sectional study (National database) | ED/Tertiary-care center       | Patients > 18 yr, BP > 180/100 mmHg | 10 219 | 1.46% (n = 2506)               | 66 (65–78)             | 40.9            | 188 (172–206)                   | 61.7         | Chest pain (21.8), Dyspnea (18.7), Impaired consciousness (17.4)   | Stroke (43), ACS (25.3), AHF (21.1)              | Admission (88.8), Discharge to home (11), Dead (2)                                  |

Abbreviations: ACS, acute coronary syndromes; AHF, acute heart failure; AKI, acute kidney injury; BP, blood pressure; ED, emergency department; HT, hypertension; ICU, intensive care unit; SBP, systolic blood pressure; SD, standard deviation; TOD, target organ damage; yr, years.

<sup>a</sup>Out of total ED patients except for Dhadke and colleagues.

<sup>b</sup>Kim and colleagues reported data in median (IQR).

<sup>c</sup>Reported data of hypertension crisis patients.

<sup>d</sup>Reported data of ICU admission patients.

**TABLE 2** National practice guidelines recommendations on acute-phase treatment in hypertensive emergency patients based on target organ damage

|                                    | The Chinese Hypertension League, The Chinese Society of Cardiology, 2018   | The Korean Society of hypertension guidelines, 2018   | The Japanese Society of Hypertension guidelines, 2019   | The Hypertension Society of India, 2013 (revised 2019)  | The Pakistan Hypertension League, 2018   | The Malaysian Society of hypertension, 2018   | The Indonesian Society of Hypertension, 2019  | The Vietnam Society of Hypertension, 2022  | Thai Hypertension Society, 2019   |
|------------------------------------|--|---|---|---|--|---|---|--|---|
| <b>Hypertensive encephalopathy</b> | For patients with sustained elevation of SBP $\geq 200$ mmHg or DBP $\geq 110$ mmHg, IV anti-HT agents should be given.  |   | 25% decrease in BP over the first 2–3 h<br>Rx: nicardipine, diltiazem, and nitroprusside  | Immediate BP reduction with IV anti-HT agents over 6–8 h with close monitoring  | Reduce MAP by 25% over 8 h<br>Rx: labetalol, nicardipine, or esmolol   | Reduce BP 20%–25% within 1 h. Note: Warning on the use of nitroprusside (increase ICP)  | Immediately reduce MAP 20%–25%<br>Rx: labetalol, nicardipine<br>Alternative Rx: nitroprusside   | Immediately reduce MAP 20%–25%<br>Rx: labetalol, nicardipine<br>Alternative Rx: nitroprusside  | Immediately reduce MAP 20%–25%<br>Rx: labetalol, nicardipine<br>Alternative Rx: nitroprusside   |
| <b>Cerebrovascular disease</b>     | If thrombolytic therapy is planned: BP should be controlled at $<180/110$ mmHg<br>Rx: IV CCB e.g., nicardipine<br>IV anti-HT agents if SBP $> 220$ mmHg, Target of BP: 160/90 mmHg | If thrombolytic therapy is planned: Treat if SBP $> 220$ mmHg or DBP $> 120$ mmHg, Target BP: 150–220 mmHg, immediate lowering of SBP may be considered with a target SBP $> 220$ mmHg (if SBP $> 220$ mmHg) Rx: IV anti-HT drug with close BP monitoring e.g., labetalol, nicardipine, diltiazem, nitroglycerin, and nitroprusside | If thrombolytic therapy is planned: Within 4.5 h of onset, IV anti-HT agent is indicated when SBP $> 185$ mmHg or DBP $> 110$ mmHg (keep $<180/105$ mmHg or 85%–90% of baseline BP)<br>Rx: IV CCB e.g., nicardipine if thrombolytic therapy is not indicated; Treat if SBP $> 220$ mmHg, Target BP: 150–220 mmHg, immediate lowering of SBP may be considered with a target SBP $> 220$ mmHg (if SBP $> 220$ mmHg) Rx: IV anti-HT drug with close BP monitoring e.g., labetalol, nicardipine, diltiazem, nitroglycerin, and nitroprusside | If thrombolytic therapy is planned: Reduce BP if SBP $> 185$ mmHg and DBP $> 110$ mmHg if thrombolytic therapy is planned, reduced BP to $<185/110$ mmHg, and maintain<br>Rx: labetalol and nicardipine<br>If thrombolytic therapy is planned, reduced BP to $<185/110$ mmHg, and maintain<br>Rx: labetalol, nicardipine, and nitroglycerin<br>If there are signs of increased ICP, maintain MAP $< 130$ mmHg if suspected normal ICP, maintain MAP $< 110$ mmHg with IV anti-HT agent SAH: Maintain SBP $< 160$ mmHg | In ischemic stroke, reduce BP only if SBP $> 220$ mmHg or DBP $> 120$ mmHg Rx: Labetalol and nicardipine<br>If thrombolytic therapy is planned, reduced BP to $<185/110$ mmHg, and maintain<br>Rx: labetalol, nicardipine, and nitroglycerin<br>If there are signs of increased ICP, maintain MAP $< 130$ mmHg if suspected normal ICP, maintain MAP $< 110$ mmHg with IV anti-HT agent SAH: Maintain SBP $< 160$ mmHg | In ischemic stroke: Reduce BP if SBP $> 220$ mmHg or DBP $> 120$ mmHg, Target BP: 10%–20% reduction from baseline level over 24 h<br>Rx: Labetalol, nicardipine, nitroglycerin<br>Agent is indicated if SBP $> 220$ mmHg, Target BP: 150–220 mmHg<br>SBP not lower than 140 mmHg within 6 h | If thrombolytic therapy is planned, BP should be controlled at $\leq 180/105$ mmHg <sup>a</sup><br>ICH: Reduce SBP until $\sim 140$ mmHg <sup>a</sup> | If thrombolytic therapy is planned, BP should be controlled when SBP $> 185$ mmHg or DBP $> 110$ mmHg<br>In the first hour, reduce MAP $\sim 15\%$<br>Rx: Labetalol, nicardipine<br>Alternative Rx: Nitroprusside<br>Immediately reduce SBP $< 180$ mmHg, but not lower than 130 mmHg Rx: Labetalol, nicardipine | If thrombolytic therapy is planned: Reduce BP to 185/110 mmHg or lower, and maintain<br>Rx: IV CCB for 24 hours<br>Rx: IV CCB e.g., nicardipine<br>Note: Warning on the use of nitrates (increase ICP), and rapid-acting nifedipine if thrombolytic therapy is not indicated: Anti-HT is indicated if SBP $> 220$ mmHg or DBP $> 120$ mmHg<br>Target BP: $\sim 15\%$ from baseline level or from baseline level or DBP $> 110$ mmHg within 30–60 min<br>ICH: Anti-HT is indicated if SBP $> 180$ mmHg<br>Target BP: SBP not lower than 140 mmHg |

(Continues)

TABLE 2 (Continued)

| Guidelines/TOD           | The Chinese Hypertension League, The Chinese Society of Cardiology, 2018   | The Korean Society of hypertension guidelines, 2018   | The Japanese Society of Hypertension guidelines, 2019                               | The Hypertension Society of India, 2013 (revised 2019)             | The Pakistan Hypertension League, 2018                                | The Malaysian Society of hypertension, 2018   | The Indonesian Society of Hypertension, 2019   | The Vietnam Society of Hypertension, 2022   | Thai Hypertension Society, 2019 |
|--------------------------|--|---|---|--|---|---|--|---|---------------------------------|
| Acute coronary syndromes | Target BP not mentioned  | Target BP not mentioned   | Target BP not mentioned Rx: IV nitroglycerine ± beta-blocker if no contraindication | Target BP not mentioned Rx: beta blockers and nitroglycerine       | Target BP not mentioned Rx: beta blockers and nitroglycerine          | BP lowering < 25% in first hour, then ≤160/100 mmHg over 2 to 6 hours, or reduced DBP 10–15% to ~110 mmHg in 30–60 minutes, if stable, further reduction toward normal BP in 1–2 days | Immediately reduce SBP < 140 mmHg Rx: Nitroglycerine, labetalol<br>Alternative Rx: Nitroprusside   | Immediately reduce SBP < 140 mmHg Rx: Nitroglycerine, labetalol<br>Alternative Rx: Nitroprusside  |                                 |
| Acute heart failure      | In cases with severe acute pulmonary edema, the reduction in BP should not exceed 25% of baseline in the first hour. Further reduced to 160/100–110 mmHg in 2–6 h later. Then gradually reduced to normal in 24–48 h Rx: IV diuretics, nitroprusside, nitroglycerine, urapidil | Reduce BP ~25% of the initial value within the first few hours <sup>b</sup> Rx: IV vasodilators and loop diuretics in combination with active anti-HT therapy | SBP should be reduced by 10%–15% Rx: Nitroprusside, nitroglycerine was recommended  | Target BP was not mentioned. Rx: IV nitroglycerine was recommended | Target SBP < 140 mmHg Rx: Nitroglycerine, vasodilators, and diuretics | Reduce BP < 25% within 1 h, then ≤160/100 mmHg over 2–6 h until symptom resolution.<br>Note: Warning on the use of beta-blockers or CCB (worsening symptoms)                          | Immediately reduce SBP < 140 mmHg Rx: Nitroprusside or nitroglycerine (with loop diuretic) Alternative Rx: Urapidil with loop diuretic                               | Acute cardiogenic pulmonary edema: Immediate reduce SBP < 140 mmHg Rx: Nitroprusside or nitroglycerine (with loop diuretic) Alternative Rx: Urapidil with loop diuretic             |                                 |
| Acute aortic dissection  | SBP should be lower than 140 mmHg within 1 h and maintained less than 120 mmHg thereafter. Rx: Beta-blockers   | Maintain SBP at 100–120 mmHg Rx: IV CCB (nicardipine, diltiazem), nitroglycerin, nitroprusside, or a beta-blocker   | SBP should be reduced by 10%–15% Rx: Nitroprusside, nitroglycerine was recommended  | Target BP was not mentioned. Rx: IV nitroglycerine was recommended | Reduce SBP < 120 mmHg within 20 min                                   | Reduce SBP to ≤120 or BP ≤120/80 mmHg, and HR to < 60 bpm within 1 h Rx: Beta-blocker before vasodilator (nicardipine Or nitroprusside)   | Immediately reduce SBP < 120 mmHg, and heart rate < 60 bpm Rx: Esmolol and nitroprusside or nitroglycerine or nicardipine<br>Alternative Rx: Labetalol or metoprolol | Immediately reduce SBP < 120 mmHg, and heart rate < 60 bpm Rx: Esmolol and nitroprusside or nitroglycerine or nicardipine<br>Alternative Rx: Labetalol or metoprolol                |                                 |
| Acute kidney injury      |  |   |   |  |   | Reduce BP to ~ 25% within 3–24 h  | Reduce MAP 20–25%  | Malignant hypertension with or without TMA or acute renal failure: Within several hours, reduce MAP 20%–25% Rx: Labetalol, nicardipine<br>Alternative Rx: Nitroprusside or urapidil |                                 |

Abbreviations: BP, blood pressure; BPM, beats per minute; CCB, calcium channel blockers; DBP, diastolic blood pressure; ED, emergency department; HT, hypertension; HTE, hypertensive emergency; ICH, intracerebral hemorrhage; ICP, intracranial pressure; ICU, intensive care unit; IV, intravenous; MAP, mean arterial pressure; SAH, subarachnoid hemorrhage; SBP, systolic blood pressure; SD, standard deviation; TMA, thrombotic microangiopathy; TOD, target organ damage.

<sup>a</sup> Recommendations from National guidelines for medical services: Stroke management, 2019.

<sup>b</sup> Recommendations from 2019 KSHF Guidelines for the Management of Acute Heart Failure.

guideline emphasized the acute phase treatment in patients with hypertensive emergency based on TOD, as shown in Table 2.

Management strategy is usually based on three factors: (1) the specific TOD, (2) the onset of the TOD, especially if the TOD is time-sensitive (e.g., acute ischemic stroke, acute ST-elevation myocardial infarction (STEMI), and (3) the facility's resources (e.g., cardiology interventionists, radiology interventionists, fibrinolytic drugs, ICU, etc.). Although the blood pressure cutoff for diagnosing hypertensive emergency is consistent across Asia, blood pressure reduction recommendations and particular management for important organ damage differed slightly.

### 3.3.1 | Hypertensive encephalopathy

Hypertensive encephalopathy was mentioned in seven national guidelines. As shown in Table 2, the Chinese Hypertension League and the Chinese Society of Cardiology did not specify how quickly to lower blood pressure.<sup>15</sup> In contrast, the other guidelines did.<sup>13,16–20</sup> These guidelines suggested lowering blood pressure by 20%–25% from its initial point. The recommended time for lowering blood pressure varies from immediate to several hours. (Table 2) The antihypertensive drugs of choice are intravenous (IV) nicardipine, diltiazem, and nitroprusside.<sup>13</sup> However, the Malaysian guidelines advised against using nitroprusside due to its tendency to lead to intracranial edema.<sup>17</sup>

### 3.3.2 | Cerebrovascular disease

Cerebrovascular disorders are mentioned in all national hypertension practice guidelines that we examined.<sup>12–20</sup> The Korean,<sup>12</sup> Japanese,<sup>13</sup> Thai,<sup>14</sup> Indian,<sup>16</sup> and Pakistan guidelines<sup>18</sup> complied with the latest American stroke guidelines,<sup>20</sup> which stated that before administering thrombolytic therapy, blood pressure should be lowered to <185/110 mmHg and that the goal blood pressure after administering thrombolytic therapy should be <180/105 mmHg in the first 24 h. While the Chinese and the Indonesian guidelines recommended a target blood pressure of 180/110 mmHg and 180/105 mmHg both before and after thrombolytic therapy, respectively.<sup>15,19</sup> Six national guidelines<sup>13,14,15,17,18,20</sup> suggested IV nicardipine as an antihypertensive medication of choice. The Malaysian guidelines recommend labetalol and nitroglycerine,<sup>17</sup> while the Thai guidelines do not recommend using nitrates as the initial medication to reduce blood pressure because it can elevate intracranial pressure (ICP).<sup>14</sup> The antihypertensive medicine of choice was not specified in the Korean or Indian guidelines.<sup>12,16</sup> In ischemic stroke patients where thrombolytic therapy is not planned, six national guidelines (excluding the Chinese, Indonesian, and Vietnam guidelines) uniformly advocated lowering blood pressure when SBP is >220 or DBP is >120 mmHg.<sup>12–18</sup> In the case of ICH, most guidelines differed on the BP threshold for initiating IV antihypertensive therapy. Most guidelines, however, recommended a blood pressure target of not less than 140 mmHg, as shown in Table 2.<sup>12–20</sup> The Pakistan recommendation was the only one that pro-

posed using signs and symptoms of elevated ICP to determine the blood pressure threshold in ICH. According to the guidelines, if there is evidence of increased ICP, mean arterial blood pressure (MAP) should be maintained at around 130 mmHg.<sup>18</sup> In terms of the antihypertensive medication, both the Korean and Japanese guidelines suggested IV nicardipine, whereas only the Korean guidelines explicitly indicated IV labetalol, diltiazem, nitroglycerin, and nitroprusside.<sup>12</sup> Oral antihypertensive medicines were recommended in the Japanese guidelines, but no recommendation for oral agents was mentioned in any other guidelines.<sup>13</sup>

### 3.3.3 | Acute coronary syndrome

The Malaysian guidelines suggested lowering MAP by around 25% in the first hour, then lowering blood pressure to 160/100 mmHg during the next 2–6 h in hypertensive emergency patients suspected of having ACS. The medication of choice, however, is not mentioned.<sup>17</sup> While Pakistan and Japanese guidelines did not specify a target blood pressure, they recommended IV nitroglycerine as the first-line treatment. If there are no contraindications, beta-blockers can be introduced.<sup>13,18</sup>

### 3.3.4 | Acute heart failure

In AHF, the Chinese, Korean, and Malaysian hypertension guidelines recommend reducing MAP by 25% within the first hour.<sup>12,15,17</sup> The Japanese guidelines merely urge a 10%–15% reduction in blood pressure.<sup>13</sup> The Pakistani,<sup>18</sup> Indonesian,<sup>19</sup> and Vietnamese<sup>20</sup> guidelines suggested lowering SBP to less than 140 mmHg. However, the Indian guidelines did not specify a blood pressure target.<sup>16</sup> IV diuretics and vasodilators (nitroglycerin, nitroprusside) were recommended in Japanese, Indian, and Pakistani guidelines.<sup>13,16,18</sup> Malaysian guidelines recommended against beta-blockers and calcium channel blockers because they might worsen heart failure symptoms.<sup>17</sup>

### 3.3.5 | Acute aortic dissection

Blood pressure must be lowered as quickly as possible to minimize morbidity and mortality in a hypertensive emergency accompanied by AAD. According to Korean recommendations, the target blood pressure should be less than 140 mmHg within the first hour.<sup>12</sup> Furthermore, both blood pressure (SBP, 100–120 mmHg) and heart rate (HR, less than 60 beats per minute) should be reduced significantly as soon as possible, according to Malaysian, Indonesian, and Vietnamese guidelines.<sup>17,19–20</sup> The Japanese guidelines, on the other hand, did not establish a target HR.<sup>13</sup> For the antihypertensive medication of choice, the Korean, Malaysian, and Vietnamese guidelines recommend beta-blockers.<sup>12,17,20</sup> Vasodilators (e.g., nicardipine or nitroprusside) should be given after beta-blockers, according to Malaysian recommendations.<sup>17</sup> IV calcium channel blockers (such as nicardipine, diltiazem), nitroglycerin, nitroprusside, or a beta-blocker

were recommended by the Japanese guidelines. However, they did not specify which medicine should be used as first-line therapy.<sup>13</sup>

### 3.3.6 | Acute kidney injury

The Malaysian, Indonesian, and Vietnamese guidelines all addressed this type of TOD.<sup>17,19–20</sup> They recommended lowering blood pressure by 20%–25% from baseline. The Malaysian guidelines advocated lowering blood pressure within 3–24 h as a target for AKI. However, no specific medication was proposed,<sup>17</sup> while the Vietnamese guidelines recommended labetalol and nicardipine as the preferred medications.<sup>20</sup>

## 3.4 | Outcomes

According to studies from Thailand<sup>6</sup> and Korea,<sup>7</sup> hypertensive emergency patients who presented to the ED were commonly admitted to the hospital, with an admission rate of over 80%. Hypertensive urgency patients had a 3.5 times lower admission rate than hypertensive emergency patients, according to the Korean study.<sup>7</sup> The study from Thailand reported that 8.7% of patients were admitted to the ICU.<sup>6</sup> Both studies had a low mortality rate of .1%. Unfortunately, no final outcomes were reported in the other studies.<sup>8–10</sup>

## 4 | IMPLICATIONS AND PERSPECTIVES

The prevalence of hypertensive emergencies in Asia ranged from .1% to 1.5%, compared to .6%–3.2% in Americans.<sup>22,23</sup> Stroke was the most common TOD in Asians. The next most common type of TOD varies from country to country. Most hypertensive emergency patients needed to be admitted to the hospital, but the mortality rate was low. Half of the studies included, however, had a relatively small number of patients.<sup>8–10</sup>

Hypertensive emergencies in the ED were less common in Asians than in western populations.<sup>4,5,22</sup> The disparity in the prevalence of hypertensive emergencies in Asia was primarily due to the demographics and types of studies used. In the study from Korea, which had the greatest prevalence of hypertensive emergencies in the ED, the data collection was countrywide and had a fairly robust method of data gathering.<sup>7</sup> Insufficient data or recall bias could also be the explanation for a lower disease prevalence in the other studies, which were cross-sectional or retrospective in nature.<sup>6,8–10</sup> As a result, a further prospective study or multinational registry is required to understand the precise epidemiology of hypertensive crises across Asia.

Hypertensive emergencies presented with a wide range of symptoms. Dyspnea was the most common presenting symptom in all populations, but it was ambiguous and nonspecific for identifying TOD.<sup>6–10</sup> Therefore, it is essential to note that patients with severe hypertension and dyspnea should always be evaluated for TOD. Other signs and symptoms, such as neurological impairments and chest pain,

could indicate brain and cardiovascular system diseases. Even though AKI was one of the most common TOD, there was no report of oliguria as the presenting symptom.<sup>8</sup>

The brain, specifically, stroke was the most common organ-related involvement of hypertensive emergencies in East and Southeast Asians. Stroke was prevalent in about 40% of the hypertensive emergency patients presenting to ED.<sup>6,7</sup> In the study from Thailand, the majority of stroke patients were ischemic type,<sup>6</sup> as was the case in the Korean study, where the ischemic stroke was two times more common than hemorrhagic stroke.<sup>7</sup> This conclusion corresponded to the fact that ischemic stroke is more common than hemorrhagic stroke in the general population.<sup>24</sup> Surprisingly, the most common TOD in South Asians, specifically Pakistanis, was AKI.<sup>8</sup> The second most prevalent TOD, according to the study from Indonesia, was also AKI<sup>9</sup>; however, the studies from Korea and Thailand found a substantially lower prevalence of AKI in their populations.<sup>6,7</sup> There was no apparent explanation for the variance in AKI prevalence between different populations. However, it could be attributable to differing diagnostic criteria utilized for determining AKI in each study. Other confounding factors, such as concomitant disease, for example, diabetes mellitus, chronic kidney disease (CKD), explicit drug use, and food preferences based on cultural backgrounds, must also be considered. In future investigations, there are opportunities to improve these constraints. The diagnostic criteria for each TOD should be standardized. Using the same inclusion and exclusion criteria will also help to eliminate confounding factors.

The management guidelines for hypertensive emergencies were consistent across Asia, particularly regarding the medications used to reduce blood pressure. The recommendations for reducing blood pressure for acute stroke were the most comparable across all national guidelines,<sup>12–20</sup> and they were also compatible with global-standard practice guidelines.<sup>24</sup> On the other hand, some national hypertension guidelines provided insufficient guidance on treating acute cardiovascular conditions such as ACS and AHF.<sup>13–16</sup> This could be because there are other standard guidelines for such conditions. However, to make the hypertension guidelines more comprehensive, it would be beneficial if they contained a section on ACS and AHF. Moreover, the recommendation on AKI was the most restricted. Only three of the guidelines we reviewed suggest the management for lowering blood pressure in patients who experience AKI.<sup>17,19,20</sup> To the best of our knowledge, clinical trials demonstrating the benefits of lowering blood pressure in a hypertensive emergency with AKI are scarce. The difficulty in selecting whether or not to lower blood pressure in individuals with a low estimated glomerular filtration rate is distinguishing between CKD and AKI induced by a hypertensive episode, especially if serum creatinine rises considerably within a few days to weeks.<sup>25</sup> More research is required to narrow the knowledge gap; however, decreasing blood pressure to 140/90 mmHg with IV anti-hypertensive medications appears to be safe. Overall, until there are randomized clinical trials focusing on hypertensive emergencies and each TOD, we recommend following the conventional guidelines for TOD treatment based on organ involvement. In most situations, mean arterial blood pressure can be lowered by 15%–25% within the first few hours.



The strength of this study is that we examined scientific evidence from Asian populations across all regions. However, we were unable to draw firm conclusions on some points, such as the true prevalence of each TOD and the consistent recommendation on some TOD management, due to a lack of studies/guidelines with complete data on such, and according to a relatively small number of hypertensive emergencies in half of the included studies. Hence, a multinational data repository on hypertensive emergencies and Asian guidelines on hypertensive emergency management is critical.

In conclusion, patients with hypertensive emergencies were regularly found in the emergency department. Stroke was the most common organ injury among Asians presenting as a hypertensive emergency. Despite a high hospital admission rate, the overall death rate was modest. Given the current lack of data among Asian countries, a multinational data repository on hypertensive emergencies and Asian guidelines on hypertensive emergency management is mandatory.

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### CONFLICTS OF INTEREST

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