Emergency Department Adherence to American Heart Association Guidelines for Blood Pressure Management in Acute Ischemic Stroke

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Background and Purpose—Severely elevated blood pressure (BP) and aggressive BP reduction are both associated with poor outcome in acute ischemic stroke (AIS). In nontissue-type plasminogen activator patients, the American Heart Association recommends antihypertensive therapy only if BP is ≥220/120 mm Hg with a goal of 15% to 25% reduction in the first 24 hours. We hypothesized that patients with AIS often receive antihypertensives in the emergency department below the recommended threshold and that BP reduction is often >20%.

Methods—In 2005, AIS cases were ascertained at all 16 hospitals in Greater Cincinnati. BP was recorded at emergency department presentation and before and after antihypertensive treatment. Hypertension was defined as BP ≥220/120 mm Hg. Chi-square and Mann-Whitney U tests were used for comparisons.

Results—A total of 1739 patients with AIS met inclusion criteria. Median age was 72 years with 43% male and 25% black. Of 218 treated with antihypertensives, 65 (30.0%) met treatment criteria immediately before treatment. Treated patients were younger (66 versus 73 years, P<0.001) with greater stroke severity than untreated patients (National Institutes of Health Stroke Scale score 4 versus 3, P=0.028). Median change in systolic BP was −25 mm Hg (range, −96 to 25 mm Hg). Median percentage change in systolic BP was −12.3% (range, −49.2% to 16.1%). Systolic BP decreased >20% in 52 treated patients (23.7%).

Conclusions—Only one third of patients with AIS treated with antihypertensives met American Heart Association-recommended treatment criteria, and the rate of change of BP was frequently greater than recommended. Further studies are warranted to determine the impact of practice patterns on AIS outcomes. (Stroke. 2012;43:557-559.)

Key Words: acute stroke ■ blood pressure ■ cerebral infarct ■ emergency medicine

Blood pressure (BP) elevation is common in acute ischemic stroke (AIS).1,2 Severely elevated systolic BP (SBP) is associated with increased risk of neurological decline and poor outcome in AIS.3 However, aggressively lowering SBP is also associated with neurological decline and poor outcome.4 For every 10-mm Hg fall in SBP <150 mm Hg, there is a 17.9% increase in risk of death at 14 days.2 Thus, unwarranted BP reduction may be harmful in AIS. American Heart Association (AHA) guidelines for the management of BP in AIS recommend antihypertensive therapy only if BP is >220/120 mm Hg with a goal of 15% to 25% BP reduction in the first 24 hours.3 In this study, we assessed adherence by emergency physicians to the AHA BP treatment guidelines for AIS. We sought to describe practice patterns in BP management among treating emergency department (ED) physicians within our population. We hypothesized that patients with AIS with BP below the recommended treatment threshold often receive antihypertensives in the ED and that BP reduction >20% occurs early in treated patients.

Methods

The Greater Cincinnati/Northern Kentucky Stroke Study is a population-based epidemiological study designed to measure incidence rates and temporal trends of stroke within a biracial population of the 1.3 million residents of the Greater Cincinnati/Northern Kentucky region (5 counties bordering the Ohio River).4 Although residents of nearby counties seek care at these hospitals, only residents of the 5 counties were included. The study period was January 1 to December 31, 2005. Detailed methods for case ascertainment and data collection have been previously described.4

For this analysis, cases were limited to AIS cases presenting to all 16 EDs in the region. Transient ischemic attacks were excluded. BP was recorded at ED presentation and before and after treatment with antihypertensives, if given. Cases were classified based on presenting BP as hypertensive (BP ≥220/120 mm Hg), hypertensive (SBP <100 mm Hg), or normotensive (neither hypertensive nor meeting AHA criteria for antihypertensive therapy).3 Cases who received recombinant tissue-type plasminogen activator were excluded. For patients receiving antihypertensives, treatment was recorded up to a maximum of 3 doses and/or medications. Recorded BP immediately before and after each dose was abstracted and...
percent change of SBP with treatment was calculated. Chi-square tests and Mann-Whitney U tests were used for comparisons.

Results

There were 1739 cases of adult patients with AIS presenting to local EDs included for this analysis. Median age of AIS cases was 72 years; 43.4% were male, and 24.2% were black. Baseline demographics of treated versus untreated cases are described in Table 1. A greater proportion of blacks were treated for hypertension (18.6% versus 10.7%, \( P < 0.001 \)). Among those who met criteria for BP-lowering, the proportion treated was not statistically different between blacks and whites (70% versus 59.4%, \( P = 0.370 \)). Among those who did not meet criteria, significantly more blacks were treated than whites (13.5% versus 8.3%, \( P = 0.004 \)). Treated cases were younger than untreated (66 versus 73 years, \( P < 0.001 \)), and treated cases had greater stroke severity than untreated (National Institutes of Health Stroke Scale score 4 versus 3, \( P = 0.001 \)).

At presentation, 109 cases (6.3%) met AHA criteria for BP-lowering, of which 69 (63.3%) received antihypertensive therapy. Forty cases (36.7%) met treatment criteria but were not treated. There were 219 cases treated with antihypertensives, of which 69 (63.3%) received antihypertensive therapy was often given despite not meeting treatment criteria, not consistent with AHA guidelines. Antihypertensive therapy was often given despite not meeting treatment criteria, and the reduction in SBP was >20 mm Hg in 115 treated cases (52.5%) and by >20% in 52 treated cases (23.7%). Three cases became hypertensive after treatment.

Discussion

This study of 16 hospitals, representing academic and community hospitals in both urban and suburban neighborhoods, is the first to compare “real-world” ED BP management with AHA recommendations. ED management of BP in AIS was not consistent with AHA guidelines. Antihypertensive therapy was often given despite not meeting treatment criteria, and the reduction in SBP was >20% in 1 of 4 treated cases. Interestingly, 1 in 3 cases who met AHA criteria for treatment did not receive antihypertensives.

Physicians may consider hypertension with AIS a form of hypertensive emergency. The treatment for hypertensive emergency, as in decompenated heart failure or aortic dissection, involves early aggressive BP reduction. Thus, aggressive management of BP in AIS seen in this study may be due to approaching AIS as a hypertensive emergency. Our findings may indicate a need for additional education regarding BP management in AIS.

Importantly, the AHA guidelines for BP-lowering in AIS are based on limited data. Although there is an association between extremes in BP and worse outcome after AIS, few trials address the question of whether BP intervention improves outcome. Small randomized studies demonstrated a negative outcome effect after BP-lowering.5,6 Other trials have been inconclusive.7 Recent trials of modest BP-lowering have shown promise.8,9 Overall, due to conflicting data between small trials, definitive conclusions on early BP reduction after AIS cannot be made. Larger randomized

### Table 1. Characteristics of Patients Treated and Not Treated With Antihypertensives

<table>
<thead>
<tr>
<th></th>
<th>Not Treated ( (N=1520) )</th>
<th>Treated ( (N=219) )</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median age, y (range)</td>
<td>73 (20–105)</td>
<td>66 (38–94)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Female, no. (%)</td>
<td>863 (56.8)</td>
<td>121 (55.3)</td>
<td>0.663</td>
</tr>
<tr>
<td>Black, no. (%)</td>
<td>341 (22.4)</td>
<td>78 (35.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Median retrospective National Institutes of Health Stroke Scale score (range)</td>
<td>3 (0–40)</td>
<td>4 (0–37)</td>
<td>0.028</td>
</tr>
</tbody>
</table>

### Table 2. Blood Pressure at Emergency Department Presentation

<table>
<thead>
<tr>
<th></th>
<th>Not Treated ( (N=1520) )</th>
<th>Treated ( (N=219) )</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial ED systolic BP, mm Hg, median (range)</td>
<td>152 (66–267)</td>
<td>198 (112–280)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Initial ED diastolic BP, mm Hg, median (range)</td>
<td>81 (0–185)</td>
<td>101 (51–183)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hypotensive* at presentation, no. (%)</td>
<td>42 (2.8)</td>
<td>0 (0.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Normal BP at presentation, no. (%)</td>
<td>1431 (94.6)</td>
<td>150 (68.5)</td>
<td></td>
</tr>
<tr>
<td>Hypertensive at presentation, no. (%)</td>
<td>40 (2.6)</td>
<td>69 (31.5)</td>
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<table>
<thead>
<tr>
<th></th>
<th>( (N=217) )</th>
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</thead>
<tbody>
<tr>
<td>Percent change SBP after first antihypertensive treatment</td>
<td>-12.3 (-49.2 to 16.1)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Percent change SBP after second antihypertensive treatment</td>
<td>-10.7 (-51.8 to 21.1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Percent change SBP after third antihypertensive treatment</td>
<td>-13.0 (-62.2 to 7.5)</td>
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</tr>
</tbody>
</table>

BP indicates blood pressure; SBP, systolic blood pressure. *Data are medians (ranges) or frequencies (percents) as appropriate. Hypertension: BP ≥220/110 mm Hg. Hypotension: SBP <100 mm Hg. Not all treated patients had BP measurements available before and after treatment.
controlled trials are needed and ongoing (Efficacy of Nitric Oxide in Stroke [ENOS] trial).

Limitations of our study include its retrospective data collection, unknown prestroke baseline BP and inability to assess “relative” hypertension or hypotension for each patient, unknown indications for antihypertensive therapy, limited generalizability beyond our population, and unknown impact of BP management on patient outcomes.

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Disclosures
None.

References
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