Blood Pressure Course In Patients With Acute Stroke and Matched Controls

M. BRITTON, M.D., A. CARLSSON, M.D., AND U. DE FAIRE, M.D.

SUMMARY The natural course of blood pressure (BP) was studied after emergency hospitalization in 209 consecutive stroke patients and as many age and sex matched controls. Histories of hypertension were more common among patients than controls (46% vs 26%). On admission 69% of the stroke group and 36% of the controls had BP > 170/100 mm Hg. In the first four days there was a spontaneous BP decline, which was greater the higher the initial values. During the whole hospitalization though, stroke patients with previous hypertension had the highest BP levels and previously normotensive controls the lowest.

Even if WHO as well as the Joint Committee for Stroke have recommended cautious antihypertensive therapy in stroke patients with extreme hypertension, such therapy is not evaluated. If this is to be done, the present findings have to be taken into consideration. Stroke controls, matched according to the initial BP level, will thus be required.

The question of treatment must be answered in the light of knowledge about the spontaneous BP course. Wallace et al found a gradual decrease of BP in 334 stroke patients referred to them for treatment. Our aim was to study consecutive, nonselected patients and to evaluate whether the BP reaction was specific for stroke patients. Or was it merely a common response to acute disease and hospitalization in elderly subjects? A comparison was therefore made with age and sex-matched controls admitted for acute disorders other than stroke.

Material and Methods

Included in this study were 209 patients consecutively admitted to the Stroke Unit at the Medical Department of Serafimer Hospital in Stockholm. The hospital served all inhabitants in a defined area of Stockholm and the unit admitted a representative part of the stroke cases. In the group studied were 113 men (mean age 71, range 50-94 years) and 96 women (mean age 76, range 50-96 years).

As admission criteria, acute onset of focal neurological deficit was required. Attacks of vertigo or syncope without focal neurological deficit were not included. In addition to fulfillment of the admission criteria, the following diagnostic definitions were used: cerebral hemorrhage — hemorrhagic cerebrospinal fluid (CSF) or intracerebral hemorrhage at CT scan; atherothrombotic brain infarction — bleeding had been excluded with CSF analyses or CT scan; cerebral embolus — the same as for atherothrombotic
TABLE 1: Distribution of Diagnoses in 209 Surgical Control Patients

<table>
<thead>
<tr>
<th>Diagnoses</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer</td>
<td>17</td>
</tr>
<tr>
<td>Gastrointestinal diseases</td>
<td>85</td>
</tr>
<tr>
<td>Urinary tract diseases</td>
<td>14</td>
</tr>
<tr>
<td>Low back pain</td>
<td>7</td>
</tr>
<tr>
<td>Traumatic disorders</td>
<td></td>
</tr>
<tr>
<td>fractures</td>
<td>59</td>
</tr>
<tr>
<td>other traumatic disorders</td>
<td>14</td>
</tr>
<tr>
<td>Circulatory diseases</td>
<td></td>
</tr>
<tr>
<td>congestive heart failure</td>
<td>3</td>
</tr>
<tr>
<td>aortic aneurysm</td>
<td>1</td>
</tr>
<tr>
<td>arteriosclerosis of leg arteries</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>209</td>
</tr>
</tbody>
</table>

Brain infarction plus an embolic source like atrial fibrillation, valvular disease or myocardial infarction within the last month; TIA — focal neurological deficit with duration of less than 24 hours; acute but ill defined cerebrovascular disease — the above investigative results missing or impossible to interpret. Subarachnoid hemorrhages were not included.

In accordance with this criteria, the following distribution of stroke diagnoses was seen: Cerebral hemorrhage 8%, cerebral thrombosis 59%, cerebral embolism 20%, TIA 11% and acute but ill defined cerebrovascular disease 2%.

Controls were recruited from the Surgical Department of the hospital. Patients admitted via the Casualty Department, the same as for the stroke patients, to a general ward for acute surgical problems were maintained on it, apart from less than ten patients who lost the ability, or were not allowed for surgical reasons, to swallow their pills. The antihypertensive drugs used were in accordance with Swedish traditions. Diuretics were used in all and beta adrenergic blocking agents (preferably propranolol) in about 10% of the patients treated for hypertension. Less than 15 patients had calcium blocking agents (verapamil) or vasodilators (hydralazine).

The statistical methods used were: Student’s t-test, chi-square and linear regression analysis. Significance levels considered were 5, 1 and 0.1%.

Results

Among the stroke patients 46% had a history of hypertension, as compared to 26% of the controls (p < 0.001). On admission to hospital 69% of patients and 36% of controls had a systolic BP ≥ 170 mm Hg or a diastolic BP ≥ 100 mm Hg. In table 2 it can be seen that, irrespective of the level chosen to define hypertension, this was always much more common among patients than controls.

If patient and control groups were divided according to history or no history of hypertension, it was obvious that the BP levels were higher if a history of hypertension was present (fig. 1). During the first four days of the stay in hospital, stroke patients without a history of hypertension exhibited higher BP levels than controls with such a history.

Mean BP gradually decreased with the time after hospitalization. In all groups, patients and controls

<table>
<thead>
<tr>
<th>BP levels (% of n)</th>
<th>Stroke</th>
<th>Control</th>
<th>Stroke</th>
<th>Control</th>
<th>Stroke</th>
<th>Control</th>
<th>Stroke</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 205/115</td>
<td>n = 207</td>
<td>p = 0.001</td>
<td>n = 207</td>
<td>p = 0.001</td>
<td>n = 204</td>
<td>p = 0.001</td>
<td>n = 198</td>
<td>p = 0.001</td>
</tr>
<tr>
<td>≥ 195/110</td>
<td>21</td>
<td>3</td>
<td>11</td>
<td>2</td>
<td>6</td>
<td>NS</td>
<td>0</td>
<td>NS</td>
</tr>
<tr>
<td>≥ 185/105</td>
<td>35</td>
<td>11</td>
<td>20</td>
<td>6</td>
<td>10</td>
<td>†</td>
<td>4</td>
<td>NS</td>
</tr>
<tr>
<td>≥ 175/100</td>
<td>49</td>
<td>21</td>
<td>28</td>
<td>8</td>
<td>14</td>
<td>†</td>
<td>7</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>64</td>
<td>33</td>
<td>43</td>
<td>17</td>
<td>27</td>
<td>†</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

Mean BP gradually decreased with the time after hospitalization. In all groups, patients and controls
Blood pressure in acute stroke

Brinton et al

Spontaneous BP course for stroke patients and controls during hospital stay. The standard deviation is given only for the groups with the highest and the lowest BP, but was in between for the remaining two groups. SH = Stroke patients with a history of Hypertension; SNH = Stroke patients with No history of Hypertension; CH = Controls with a history of Hypertension; CNH = Controls with No history of Hypertension.

Discussion

High BP levels with a marked spontaneous decline were found in acute stroke patients after hospitalization. The highest values were recorded in previously hypertensive subjects. This is in accordance with the findings of Wallace et al., although the materials differed. Their patients were mainly male, veterans, and had a lower mean age. Some were transferred from other hospitals, wherefore admission was delayed. Still, this main conclusion can be drawn from both studies and are further supported by data in a recent abstract.7

The same type of BP reaction was noted in the controls. In spite of a thorough search, we have not been able to find any documentation about the spontaneous BP course in patients hospitalized for acute illnesses, neither as regards normotensive nor hypertensive subjects. Nor have the studies here referred to been able to find earlier documentation on the subject. The 28 male controls included in Wallace’s study were not admitted as emergencies.5 Their previous BP status was not mentioned and mean BP on admission (about

with as well as without a history of hypertension, there was a significant (p < 0.001) difference between BP on admission and at day four (fig. 1). The decline was greater the higher the initial BP. Regression lines were computed between admission BP and degree of decline for the four groups of subjects, and for systolic as well as diastolic BP. In figure 2, the regression line for systolic BP in stroke patients with previous hypertension is presented. Regression was similar for patients and controls, for systolic and diastolic BP, and irrespective of previous hypertension or not.

After day four, the BP decline diminished, as did the BP difference between patients and controls (table 2). However, even at discharge previously hypertensive stroke patients had the highest BP and normotensive controls the lowest (fig. 1).

There was no statistically significant difference between men and women as regards BP course, mean systolic and mean diastolic BP. The 17 patients with cerebral hemorrhage had a significantly higher mean diastolic BP on admission, day 1 and day 4, than patients with other stroke diagnoses (table 3).

During the stay in hospital, 35 of the stroke patients died. Their mean BP on admission was 178/97 mm Hg, compared to 179/95 mm Hg for those who survived (NS). Controls without BP recording on day four did not differ from the remainder on admission or day one. These withdrawals from the groups therefore should not have influenced the results to any important degree. Discharge BP in the controls is based on only half of the initial group. Thus it is more uncertain, although this half did not differ from the other half group at the earlier recordings.

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140/80 mm Hg) was remarkably low. No reaction was seen and perhaps was not possible under the existing conditions. Similar objections can be raised against the findings concerning 49 controls only described in an abstract. It is unknown, however, if the increase is correlated to the BP course or if this is merely a consequence of other mechanisms.

The acute stroke patients, as well as many other patients with acute disorders, have an increased sympathetic activity. It is unknown, however, if the increase is correlated to the BP course or if this is merely a consequence of other mechanisms.

It is still questionable whether it is beneficial to treat hypertension in acute ischemic or haemorrhagic stroke. A study needs to be done as to whether acute lowering of the BP versus the natural lowering would be more efficacious. In that study it is important to show that treatment brings about a faster or greater BP decline than the spontaneous one. Thus untreated stroke patients must be used as controls and all subjects stratified according to initial BP level.

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**References**

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