Prevalence of Isolated Systolic Hypertension and the Awareness, Treatment, and Control Rate of Hypertension in Kinmen

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Background: It has been shown that isolated systolic hypertension (ISH) is the majority subtype of uncontrolled hypertension. The present study was aimed to investigate the prevalence of hypertension subtypes, ISH in particular, and also the rates of hypertension awareness, treatment and control in Kinmen County.

Method: The fieldwork of a community-based survey was carried out in Kinmen during 1991-1992. A total of 12,396 residents aged 30 years and older were interviewed and their blood pressure measured.

Results: The prevalence was 35.2% for hypertension and 12.6% for ISH in Kinmen. The most common hypertension subtype was systolic/diastolic hypertension (SDH). The rates of awareness, treatment, and control of high blood pressure were 31.5%, 21.7%, and 4.0%, respectively. The prevalence of ISH in the hypertensive subjects was below 50% until seventh decade. The proportion of SDH dominated in both the untreated and inadequately treated hypertensive individuals until the age of 60 or 70 years, respectively. Sixty-one percent and 37.2% of the inadequately treated elderly (age ≥ 50 years) didn’t reach treatment goals for SBP and DBP, respectively. In contrast, 34.6% and 40.9% of the inadequately treated younger individuals (age < 50 years) did not reach treatment target for SBP and DBP, respectively.

Conclusions: ISH was predominant in the elderly, but SDH was the most prevalent subtype of uncontrolled hypertension in Kinmen. The distinct patterns of systolic and diastolic hypertension were probably related to the low awareness, treatment, and control rates of hypertension. More efforts would be required to improve hypertension control in Kinmen.

Key Words: Isolated systolic hypertension • Hypertension control • Epidemiology

INTRODUCTION

The prevalence of isolated systolic hypertension (ISH) increases with advancing age. Framingham Heart Study has shown that systolic blood pressure (SBP) plays a greater role in determining the risk of future cardiovascular events than does diastolic blood pressure (DBP). Several clinical studies also supported that reduction in systolic blood pressure could reduce the risk of myocardial infarction, stroke, and congestive heart failure. In the National Health and Nutrition Examination Survey (NHANES) III, it was demonstrated that ISH was the most common hypertension subtype in untreated and inadequately treated hypertensive individuals. The prevalence and incidence of ISH vary from 3% to 30% and are dependent on the adopted definition, and methodology of blood pressure measurement, as well as the study population and its age and sex distribution. In particular, the prevalence and burden of ISH,
isolated diastolic hypertension (IDH), and combined systolic and diastolic hypertension (SDH) may differ in a community with limited medical resource, such as Kinmen County, from those with affluent communities in the United States.10

Successful implementation of hypertension guidelines should improve quality of patient care. The key components are patients’ awareness of hypertension and physicians’ adherence to treatment guidelines.12 Therefore, the present study was aimed to investigate the prevalence of hypertension subtypes, and also the rates of hypertension awareness, treatment and control in Kinmen.

METHOD

Study Population

Kinmen county of Taiwan has a population of around 45,000 residing on one principal island (Quemoy) and several nearby islets; all are very close to the southern mainland China.13 During the period 1991-1995, all residents over 30 years of age in five major townships (Kin-Hu, Kin-Chen, Kin-Sa, Kin-Nin, and Lieh-Yu) in Kinmen were surveyed by the Yang-Ming Crusade, a volunteer organization of the medical students from the National Yang-Ming University.14 In each village, all eligible subjects were invited to the community center to participate in a health survey. Characteristics of the target population and the methodology have been reported.15,16 A total of 12,396 subjects (≥ 30 years old) were enrolled in this study. The overall response rate was 61.4%, based on a target population of 20,185 by household registration.

Criteria of Hypertension and Adequate Blood Pressure Control

Three blood pressure measurements separated by at least five minutes from the right arms of subjects after they were seated for at least 5 minutes were taken manually using a mercury sphygmomanometer and a standard-sized cuff (13 cm × 50 cm) by well-trained medical students or public health nurses. Palpated radial pulse obliteration pressure was used to estimate SBP. Then the cuff was inflated 20-30 mmHg above this level for the auscultatory determinations. The cuff deflation rate for auscultatory readings was 2 mmHg per second. SBP was the point at which the first of two or more Korotkoff sounds was heard (onset of phase 1), and the disappearance of Korotkoff sound (onset of phase 5) was used to define DBP.

The definition of hypertension was SBP ≥ 140 mmHg, DBP (90 mmHg, or the use of antihypertensive medication. Awareness of hypertension was defined by interviewing hypertensive individuals themselves during interview participating. Treatment of hypertension was defined as use of medication for controlling blood pressure at the time of interview. The definition of successful treatment (control) was to treat SBP and DBP to targets (SBP < 140 and DBP < 90 mmHg). The definition of inadequate treatment was failure to treat SBP and DBP to targets (SBP ≥ 140 mmHg or DBP ≥ 90 mmHg) with pharmacological treatment of hypertension. The above definitions were in conformity with the Seventh Report of the joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-VII).17 Hypertension subtypes included IDH (defined as SBP < 140 and DBP < 90 mmHg), SDH (defined as SBP ≥ 140 and DBP ≥ 90 mmHg), and ISH (SBP ≥ 140 and DBP < 90 mmHg).

Statistic Analysis

The study population was stratified by age (< 50 or ≥ 50 years), status of treatment, and hypertensive subtypes. Prevalence of different hypertensive subtypes was determined in untreated and inadequately treated individuals by each decade. The SBP, DBP, and the difference between BP and treatment target were determined for the 3 hypertensive subtypes in both the untreated and inadequately treated groups, dichotomized at 50 years of age.

The distribution of hypertension subtypes in stratification of age was descriptively analyzed. The χ² test was used for comparing proportions. Independent student t-test was used for comparing the means of blood pressure between groups. p value less than 0.05 was considered statistically significant. Data analysis was carried out with SAS 8.02.
RESULTS

Hypertension Prevalence and Rates of Awareness, Treatment and Control in Kinmen

The prevalence of hypertension was 41.9% in men and 29.9% in women aged 30 years and older. The prevalence of hypertension increased rapidly with advancing age in both sexes (Table 1). Hypertension was more prevalent among men than women until 70 years old. The awareness of hypertension increased with advancing age in both men and women. Men had lower awareness of hypertension than women in most age groups. The percentage of treated hypertensive individuals increased with advancing age in both men and women, except for women over 80 years old. Very low hypertension control rates were observed in both men (3.6%) and women (4.4%) across all age groups.

Prevalence of Isolated Systolic Hypertension

The prevalence of ISH was 12.6% for the whole population. The age- and sex-stratified prevalence of ISH is shown in Table 2. The prevalence of ISH increased sharply with advancing age in both genders. Isolated systolic hypertension was more prevalent among men only in the age group of 30-39 years. After age 40, the prevalence of ISH in women exceeded that in men.

Distribution of Hypertension Subtypes

The proportion of subjects with SDH in the inadequately treated groups was greater than the combination of ISH and IDH below 70 years old.

Figure 1 shows the frequency distribution of untreated hypertensive individuals according to age groups and hypertension subtypes. The proportion of ISH among hypertension subtypes without treatment increased gradually with age. In contrast, the proportion of IDH decreased with age. More than 50% of the participants with untreated hypertension were ISH after the age of 70 years.

Figure 2 shows the frequency distribution of inadequately treated hypertensive individuals by age and hypertension subtype. The proportion of SDH dominated in

| Table 1. Awareness, treatment, and control rates of hypertension in Kinmen |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Population     | 30-39 yrs, % (N) | 40-49 yrs, % (N) | 50-59 yrs, % (N) | 60-69 yrs, % (N) | 70-79 yrs, % (N) | > 80 yrs, % (N) | Total           |
| Hypertension    |                 |                 |                 |                 |                 |                 |                 |
| Male            |                 |                 |                 |                 |                 |                 |                 |
| Female          |                 |                 |                 |                 |                 |                 |                 |
| Awareness       |                 |                 |                 |                 |                 |                 |                 |
| Male            |                 |                 |                 |                 |                 |                 |                 |
| Female          |                 |                 |                 |                 |                 |                 |                 |
| Treatment       |                 |                 |                 |                 |                 |                 |                 |
| Male            |                 |                 |                 |                 |                 |                 |                 |
| Female          |                 |                 |                 |                 |                 |                 |                 |
| Control to goal |                 |                 |                 |                 |                 |                 |                 |
| Male            |                 |                 |                 |                 |                 |                 |                 |
| Female          |                 |                 |                 |                 |                 |                 |                 |

*: *p* < 0.05 between male and female.

| Table 2. Age- and sex-stratified prevalence of isolated systolic hypertension in Kinmen |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | 30-39 yrs, % (N) | 40-49 yrs, % (N) | 50-59 yrs, % (N) | 60-69yrs, % (N) | 70-79 yrs, % (N) | > 80 yrs, % (N) | Total           |
| SBP ≥ 140 and DBP < 90 mm Hg |                 |                 |                 |                 |                 |                 |                 |
| Male            |                 |                 |                 |                 |                 |                 |                 |
| Female          |                 |                 |                 |                 |                 |                 |                 |
| Total           |                 |                 |                 |                 |                 |                 |                 |

*: *p* < 0.05 between male and female.
the inadequately treated hypertensive individuals until the age of 70 years.

Overall, the proportion of subjects with SDH in the untreated hypertension group was 41.08% and in the inadequately treated hypertension group, 59.02%.

**Treatment Gap in Hypertension**

The difference between the current blood pressure and the treatment target (treatment gap) was analyzed. Sixty-one percent and 37.2% of the inadequately treated elderly (age ≥ 50 years) did not reach target goals for SBP and DBP, respectively. In contrast, 34.6% and 40.9% of the inadequately treated younger individuals (age < 50 years) didn’t reach treatment goals for SBP and DBP, respectively. In IDH, the difference between the current DBP and the treatment target (DBP < 90 mmHg) was small (≤ 3-6 mmHg) in the untreated and inadequately treated hypertensives, both young (< 50 years) and old (≥ 50 years) (Table 3). In ISH, the difference between the current SBP and the treatment target (SBP < 140 mmHg) was largest in the inadequately treated group with old age (Table 3). In SDH, the difference between the current blood pressure and the treatment target was large for both SBP and DBP, and more remarkable in the inadequately treated group with old age (Table 3).

**DISCUSSION**

**Principle Findings**

The principle findings of the present study in Kinmen were that (a) the prevalence was 35.2% for hypertension and 12.6% for ISH; (b) the most common hypertension subtype of uncontrolled hypertension was systolic/diastolic hypertension (SDH); and (c) the rates of awareness, treatment, and control of high blood pressure were 31.5%, 21.7%, and 4.0%, respectively. The distinct patterns of systolic and diastolic hypertension were probably related to the low awareness, treatment, and control rates of hypertension in Kinmen.

The reason for the high prevalence of hypertension in Kinmen was probably due to the stressful lifestyle from potential military confrontation between mainland China and Taiwan and the long-term control under martial law. The shortage of medical resources could be responsible for the low rates of awareness, treatment, and control of high blood pressure.

Studies of ISH prevalence in Chinese population are sparse. The prevalence of ISH (SBP ≥ 140 mmHg and DBP < 90 mmHg) was 13.6% in Chinese above 15 years old in China, and 2.1% (SBP ≥ 160 mmHg and DBP < 90 mmHg) in subjects above 30 years old in Pu-Li, Taiwan. The prevalence of ISH in Kinmen and China was comparable when using the same ISH definition (SBP ≥ 140 mmHg and DBP < 90 mmHg). On the other hand, the incidence of ISH has been studied in two Taiwanese townships, Chu-Dung and Pu-Tzu. In consistence with previous studies, prevalence of ISH increased with ad-
vancing age. Significant predictors for ISH were older age, diabetes and elevated fibrinogen in men, and shorter clotting time in women.\textsuperscript{19}

The community-based Framingham Heart Study reported a higher prevalence of ISH (SBP > 140 mmHg and DBP < 90 mmHg) in untreated individuals. In the age group of 50-59 years old, the prevalence was 35\% to 40\%,\textsuperscript{20} and 65\% to 70\% above 60 years.\textsuperscript{21} In NHANES III, the ISH prevalence was 54\% in the age group of 50-59 years and 87\% in the age group of 60 years and older.\textsuperscript{10} In contrast, prevalence of ISH was low in Kinmen as compared to those reported in the above two western populations.

The success of hypertension control can be hindered by many factors. One of the main factors is the poor awareness of hypertension. The awareness of hypertension was above 50\% in Jordan,\textsuperscript{22,23} India\textsuperscript{24} and most western countries.\textsuperscript{17,25-28} In Kinmen, about two-thirds of the hypertensive individuals were not aware of their own blood pressure. The group of hypertensive individuals without awareness could lead to more risky clinical scenarios. On the other hand, the present study showed that the hypertensive subjects who were inadequately treated (with awareness) had higher SBP and DBP than those untreated individuals (without awareness). The awareness of hypertension was significantly better in women than in men for the age groups of 50-59 and 60-69 years. This finding was similar to a study of French people.\textsuperscript{29}

The results indicated that more effort should be devoted to improve hypertension awareness among those less than 50 years old and also men above 50 years old.

Based on this epidemiological survey, the proportion of hypertensive subjects receiving treatment was about 30\% in Kinmen. The rate of control of hypertension in the present study was similar to that in China,\textsuperscript{18} Bulgaria,\textsuperscript{3} and Venezuela,\textsuperscript{2} but lower than that in Jordan,\textsuperscript{23} Portugal,\textsuperscript{25} Greece,\textsuperscript{27} Netherlands,\textsuperscript{4} and other western countries. We recommended that the physicians and public health officials in Kinmen need to narrow down the marked treatment gap more aggressively in the future.

In conclusion, the prevalence of hypertension was high while the rates of awareness, treatment, and control of high blood pressure were low in Kinmen. ISH was predominant in elderly, but SDH was the most prevalent subtype of uncontrolled hypertension. More efforts would be required to improve the hypertension control in Kinmen.

\textbf{Table 3.} Mean levels of SBP, DBP, and differences between blood pressure and the treatment goal in the untreated and inadequately treated subjects

<table>
<thead>
<tr>
<th>Hypertension subtype/Blood pressure component</th>
<th>Untreated individuals</th>
<th>Inadequate treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age &lt; 50 y</td>
<td>Age ≥ 50 y</td>
</tr>
<tr>
<td>IDH, mmHg (mean ± SE)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBP</td>
<td>129.9 ± 0.3</td>
<td>131.9 ± 0.4#</td>
</tr>
<tr>
<td>DBP</td>
<td>93.1 ± 0.2</td>
<td>93.1 ± 0.2</td>
</tr>
<tr>
<td>Difference between DBP and goal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SDH, mm Hg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBP</td>
<td>153.1 ± 0.6</td>
<td>161.1 ± 0.6#</td>
</tr>
<tr>
<td>DBP</td>
<td>99.2 ± 0.4</td>
<td>98.9 ± 0.3</td>
</tr>
<tr>
<td>Difference between DBP and goal ¶</td>
<td>-9.2</td>
<td>-8.9</td>
</tr>
<tr>
<td>Difference between SBP and goal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISH, mm Hg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBP</td>
<td>147.0 ± 0.5</td>
<td>152.9 ± 0.4#</td>
</tr>
<tr>
<td>DBP</td>
<td>81.6 ± 0.4</td>
<td>79.8 ± 0.3#</td>
</tr>
<tr>
<td>Difference between SBP and goal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¶ Treatment goal of DBP in JNC-VII; < 90 mmHg
|| Treatment goal of SBP in JNC-VII; < 140 mmHg
§: \( p < 0.01 \); #:\( p < 0.001 \). ISH = isolated systolic hypertension (SBP ≥ 140 mmHg and DBP < 90 mmHg); SDH = systolic-diastolic hypertension (SBP ≥ 140 mmHg and DBP ≥ 90 mmHg); IDH = isolated diastolic hypertension (SBP < 140 mmHg and DBP ≥ 90 mmHg).
ACKNOWLEDGEMENT

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REFERENCES


金門縣收縮型高血壓盛行率及高血壓的自覺率、
接受治療比率、及控制良好比率之調查

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背景 研究顯示收縮型高血壓是高血壓未控制患者中主要的高血壓型態。本研究的目的在於調查金門地區各種高血壓分型尤其是收縮型高血壓的盛行率，以及病人對於高血壓的自覺率，接受治療的比率，及血壓控制良好的比率。

方法 本研究乃是 1991 至 1992 年在金門地區進行的實地訪查。總共有 12396 位當地 30 歲以上的居民接受訪談及量測血壓。

結果 金門地區高血壓及收縮型高血壓的盛行率為 35.2% 及 12.6%。最常見的高血壓分型為合併收縮型及舒張型的高血壓 (SDH)。高血壓病人的自覺率，接受治療的比率，及血壓控制良好的比率為 31.5%，21.7%，及 4.0%。收縮型高血壓的在高血壓病人當中的盛行率在 60-69 歲以前都低於 50%。對於 60 至 70 歲以下未接受治療或治療失敗的高血壓病人而言，合併收縮型及舒張型的高血壓 (SDH) 是最常見的血壓分型。在 50 歲以上未接受治療或治療失敗的高血壓病人當中，61%及 37.2%病人的收縮壓及舒張壓未達治療目標。在 50 歲以下未接受治療或治療失敗的高血壓病人當中，34.6%及 40.9%病人的收縮壓及舒張壓未達治療目標。

結論 金門地區高血壓的盛行率很高但是高血壓病人的自覺率，接受治療的比率，及血壓控制良好的比率卻很低。收縮型高血壓主要以老年人為主，而金門地區最常見的血壓分型是合併收縮型及舒張型的高血壓 (SDH)。對於金門地區的高血壓治療，我們仍然需要投注更多的力。

關鍵詞：獨立收縮高血壓、高血壓控制、流行病學。