Microalbuminuria Prevalence Study (MAPS) in hypertensive Patients with Type 2 Diabetes in Thailand

Peera Buranakitjaroen MD, DPhil*, Chaicharn Deerochanawong MD**, Pongamorn Bunnag MD***

* Division of Hypertension, Department of Medicine, Faculty of Medicine Siriraj Hospital, Mahidol University
** Endocrinology Unit, Department of Medicine, Rajavithi Hospital
*** Department of Medicine, Faculty of Medicine, Ramathibodi Hospital, Mahidol University

Background: Microalbuminuria represents the earliest clinical evidence of diabetic nephropathy, and is a marker of increased cardiovascular (CV) morbidity and mortality.

Objectives: This analysis of Thai data from the Microalbuminuria Prevalence Study (MAPS) assessed the prevalence of macroalbuminuria and microalbuminuria in hypertensive patients with type 2 diabetes.

Design: Cross-sectional clinic-based epidemiological study.

Material and Method: A total of 100 patients were enrolled, of which 97 patients constituted the per-protocol population (patients with bacteriuria and haematuria were excluded). Patients attended one study visit with no follow-up.

Results: Overall, the prevalence of diabetic kidney disease was high, with macroalbuminuria contributing 13.4% [9.9-16.9; 93% confidence interval (CI)] and microalbuminuria contributing 43.3% [38.3-48.3; 95%CI].

Conclusion: Annual screening for microalbuminuria is recommended for all patients with type 2 diabetes, as early treatment is critical for reducing CV risks. Clinical studies have shown that renin-angiotensin system inhibitors can slow the progression of diabetic nephropathy.

Keywords: Diabetic nephropathy, Hypertension, Albuminuria, Renin-angiotensin system, Thailand

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Patients with type 2 diabetes are at least twice as likely to have hypertension as the nondiabetic population(1). The presence of hypertension increases the risk of atherosclerotic vascular disease and microvascular complications, such as retinopathy and nephropathy, in patients with diabetes(1). The higher the systolic blood pressure (SBP), the greater the absolute excess cardiovascular (CV) risk for patients. This indicates the potential for prevention of CV death among patients with diabetes by controlling elevated blood pressure(2). The aging population and an increase in obesity and sedentary lifestyle has contributed to a steady increase in the prevalence of diabetes, particularly in Asia(3). The International Collaborative Study of Cardiovascular Disease in Asia estimated that the national prevalence of diabetes in Thai adults older than 35 years was 9.6% in 2000(4).

Because of the adverse impact of microalbuminuria and proteinuria on survival in these patients(5-7), screening and intervention programmes should be implemented as early as possible. Annual screening for microalbuminuria is recommended by the American Diabetes Association(8), the use of a semi-quantitative dipstick test is easy, and provides immediate and accurate results(9).

There have been few studies in Asian populations on the prevalence of microalbuminuria(10-12). These studies have only explored the percentage of microalbuminuria in either patients with diabetes or patients with hypertension. The Microalbuminuria Prevalence Study (MAPS) is the first study to evaluate
the prevalence of microalbuminuria and macroalbuminuria in patients with both type 2 diabetes and hypertension\textsuperscript{[13]}. The present study was a subgroup of MAPS, which included only Thai patients.

The primary study objective was to assess the prevalence rate of macroalbuminuria and microalbuminuria. Secondary objectives aimed to assess levels of glycaemic and blood pressure control.

**Material and Method**

The study design and methods of MAPS have been previously described\textsuperscript{[13]}, and a brief outline is presented here. Outpatients of different Asian ethnic subgroups, older than 18 years of age, with previously diagnosed hypertension (treated or untreated) and type 2 diabetes (treated or untreated) were consecutively screened at each participating centre. Previously diagnosed hypertension and diabetes were historically defined as mentioned in the patients’ medical records and verified during monitoring visits. Patients with known (previously diagnosed) macroalbuminuria were excluded. Patient data included demographic information, past medical history, dates of onset of hypertension and diabetes, current diabetes status (complications such as retinopathy, peripheral neuropathy, as well as CV disease, glycaemic control, current therapy), current hypertensive status (mean of two consecutive measurements of office supine SBP and diastolic blood pressure [DBP], current treatment), and dyslipidaemic status (known or previously diagnosed dyslipidaemia, use of lipid-lowering agents). A single urine specimen was collected in disposable plastic vessels on the same day as the screening visit. Micral-Test from Roche Diagnostics was used in screening for microalbuminuria.

For the current analysis, the authors restricted data to include only those patients recruited from study centres in Thailand. All patients with confirmed onset dates of hypertension and type 2 diabetes constituted the analysed population. Patients with positive leukocytes and nitrites, indicative of significant bacteriuria, and patients with erythrocytes or haemoglobin equal or above 25 microL, indicative of significant haematuria, were excluded from the analysed population to constitute the per-protocol population.

Quantitative variables were described by their mean, standard deviation, count and number of missing values. Qualitative variables were described by the counts and percentages of each response choice, missing data were included in the calculation of percentages. No statistical tests were performed on the albuminuric subgroups. Prevalence rates were calculated with a two-sided 95% confidence interval (CI).

**Results**

Thai patients constituted 1% of the overall enrolments in MAPS. A total of 100 patients were recruited from medical centres in Rajavithi, Ramathibodi and Siriraj, from October 2002 to November 2002. Patients with bacteriuria, and/or haematuria, on the Nephur\textsuperscript{7}Test (Roche Diagnostics GmbH, Mannheim, Germany), were excluded from the per-protocol analysis (Fig. 1). Demographic data of the per-protocol population (n = 97) are shown in Table 1. A family history of hypertension, diabetes, CV and kidney disease was reported in 44.33%, 57.73%, 17.53% and 5.15% of patients, respectively. Overall, 11.34% had at least one CV complication: previous transient ischaemic attack (2.06%), previous stroke (5.15%), angina pectoris (5.15%), myocardial infarction (MI) (1.03%), heart

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**Fig. 1** Patient classification
failure (1.03%) and peripheral arterial disease (1.03%). Dyslipidaemia was present in 55 (89.69%) patients (Table 2), and 63.22% were using lipid-lowering drugs (76.36% were taking statins and 29.09% were taking fibrates).

The mean duration of diabetes was 7.79 ± 6.59 years, with a mean age of onset of 53.37 ± 10.39 years. Measures of glycaemic control revealed a mean glycosylated haemoglobin (HbA1c) level of 7.68 ± 1.20% and a mean creatinine level of 86.75 ± 25.69 mmol/L. Current methods of diabetes management included dietary control in 100% of patients, regular physical exercise in 32.99%, oral hyperglycaemic agents in 94.85%, and insulin therapy in 10.31%. Twenty-four per cent of patients had at least one diabetic complication, with diabetic retinopathy and peripheral neuropathy present in 19.59% and 14.43%, respectively.

The mean duration of hypertension was 6.10 ± 5.50 years, with an average age of onset of 55.06 ± 10.31 years. Mean blood pressure was 139.13 ± 15.73/81.41 ± 8.00 mmHg. Overall, 32.99% of patients achieved the target blood pressure of 130/85 mmHg (the target level recommended by the American Diabetes Association for adequate blood pressure control at the time of study initiation). Blood pressure was normalised in 7.69%, 33.33% and 40.48% of macroalbuminuric, microalbuminuric and normoalbuminuric patients, respectively. The majority of patients (97.94%) were receiving treatment for their hypertension: 28.42% and 71.58% were receiving monotherapy and combination therapy respectively. The distribution of antihypertensive therapy was as follows: diuretics (55.79% of patients), alpha blockers (10.53%), beta blockers (49.47%), calcium channel blockers (34.74%), ACE inhibitors (52.63%) and angiotensin II receptor blockers (ARB) (6.32%).

### Table 1. Patient characteristics*

<table>
<thead>
<tr>
<th></th>
<th>Macroalbuminuric (n = 13)</th>
<th>Microalbuminuric (n = 42)</th>
<th>Normal (n = 42)</th>
<th>Total (n = 97)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male n (%)</td>
<td>5 (38.46)</td>
<td>11 (26.19)</td>
<td>13 (30.95)</td>
<td>29 (29.90)</td>
</tr>
<tr>
<td>Female n (%)</td>
<td>8 (61.54)</td>
<td>31 (73.81)</td>
<td>29 (69.05)</td>
<td>68 (70.10)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>60.38 ± 10.20</td>
<td>62.60 ± 11.02</td>
<td>59.74 ± 9.64</td>
<td>61.06 ± 10.31</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>156.69 ± 7.38</td>
<td>155.35 ± 7.72</td>
<td>157.98 ± 8.13</td>
<td>156.66 ± 7.87</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>68.51 ± 9.75</td>
<td>66.68 ± 13.20</td>
<td>66.16 ± 10.48</td>
<td>66.70 ± 11.57</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>27.81 ± 2.73</td>
<td>27.66 ± 5.48</td>
<td>26.44 ± 3.15</td>
<td>27.15 ± 4.29</td>
</tr>
<tr>
<td>Waist/hip ratio</td>
<td>0.94 ± 0.10</td>
<td>0.91 ± 0.11</td>
<td>0.90 ± 0.07</td>
<td>0.91 ± 0.09</td>
</tr>
<tr>
<td>SBP (mmHg)</td>
<td>141.15 ± 16.49</td>
<td>140.55 ± 16.14</td>
<td>137.08 ± 15.22</td>
<td>139.13 ± 15.73</td>
</tr>
<tr>
<td>DBP (mmHg)</td>
<td>83.46 ± 10.00</td>
<td>80.93 ± 8.83</td>
<td>81.25 ± 6.42</td>
<td>81.41 ± 8.00</td>
</tr>
<tr>
<td>Blood glucose (mmol/L)</td>
<td>7.80 ± 2.21</td>
<td>7.95 ± 1.81</td>
<td>7.53 ± 2.23</td>
<td>7.74 ± 2.04</td>
</tr>
<tr>
<td>Duration of hypertension (years)</td>
<td>6.92 ± 6.09</td>
<td>7.12 ± 6.43</td>
<td>4.83 ± 3.95</td>
<td>6.10 ± 5.50</td>
</tr>
<tr>
<td>Duration of diabetes (years)</td>
<td>9.23 ± 8.27</td>
<td>7.88 ± 6.17</td>
<td>7.26 ± 6.53</td>
<td>7.79 ± 6.59</td>
</tr>
</tbody>
</table>

* Per-protocol population. All values given are means ± standard deviation (with the exception of gender)

SBP, systolic blood pressure; DBP, diastolic blood pressure

### Table 2. Dyslipidaemia in hypertensive patients with type 2 diabetes*

<table>
<thead>
<tr>
<th></th>
<th>Macroalbuminuria (n = 13) %</th>
<th>Microalbuminuria (n = 35) %</th>
<th>Normal (n = 39) %</th>
<th>Total (n = 87) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertriglyceridaemia</td>
<td>76.92</td>
<td>60.00</td>
<td>48.72</td>
<td>57.47</td>
</tr>
<tr>
<td>High total cholesterol</td>
<td>92.31</td>
<td>91.43</td>
<td>92.31</td>
<td>91.95</td>
</tr>
<tr>
<td>High LDL cholesterol</td>
<td>53.85</td>
<td>62.86</td>
<td>69.23</td>
<td>64.37</td>
</tr>
<tr>
<td>Low HDL cholesterol</td>
<td>53.85</td>
<td>48.57</td>
<td>35.90</td>
<td>43.68</td>
</tr>
</tbody>
</table>

* Hyperlipidaemic population (n = 87). LDL, low-density lipoprotein, HDL, high-density lipoprotein. Numbers given are percentage of patients within each subgroup with the given category of dyslipidaemia
**Primary endpoint**

The overall prevalence of albuminuria was 56.7%. The prevalence of macroalbuminuria and microalbuminuria was 13.4% [9.9-16.9; 95%CI] and 43.3% [38.3-48.3; 95%CI], respectively.

**Secondary endpoint**

Only 32.99% (32 of 97) of patients achieved blood pressure readings below the target blood pressure of 130/85 mmHg.

**Discussion**

MAPS is the first large multicentre epidemiological study conducted in Asia to determine the prevalence of microalbuminuria and macroalbuminuria in patients with hypertension and type 2 diabetes\(^{(13)}\). This subanalysis of data from Thailand indicates that 13.4% of the per-protocol population had macroalbuminuria and 43.3% had microalbuminuria. The prevalence of microalbuminuria was much higher than rates of 17-21% reported from patients with diabetes in Western population-based studies\(^{(15)}\), and slightly higher than the mean of 39.8% reported from the overall Asian MAPS cohort\(^{(13)}\).

Almost one-third of Thai patients achieved the target blood pressure of < 130/85 mmHg, recommended by the American Diabetes Association for adequate blood pressure control at the time of study initiation\(^{(14)}\). This rate of blood pressure control is similar to rates that have been reported from many Western countries\(^{(16)}\).

The benefits of reducing blood pressure to below 130/85 mmHg in patients with diabetes are well established\(^{(17,18)}\). In the United Kingdom Prospective Diabetes Study 38 (UKPDS 38)\(^{(18)}\), each decrease of 10 mmHg in mean SBP was associated with a 15% reduction in risk for death related to diabetes, an 11% reduction in risk for MI, a 13% reduction in risk for microvascular complications and a 12% reduction in risk for any diabetes-related complications. In the Hypertension Optimal Treatment (HOT) study\(^{(19)}\), a 51% reduction in CV events was observed in patients with diabetes randomised to a group with target DBP of ≤ 80 mmHg compared with those randomised to a target DBP of ≤ 90 mmHg. It is, therefore, important to develop strategies that increase the percentage of patients who achieve optimal blood pressure control as Asian patients with type 2 diabetes have a higher risk for renal complications and stroke compared with Caucasian patients\(^{(20)}\).

Despite its complications, diabetes is largely a preventable and treatable disease. Annual screening for microalbuminuria in all patients with type 2 diabetes is recommended\(^{(21)}\), as early treatment with inhibitors of the renin-angiotensin system can help slow the progression of diabetic nephropathy\(^{(23)}\).

In conclusion, this subanalysis of data from the Thai cohort of MAPS demonstrated a 43.3% prevalence of microalbuminuria in hypertensive patients with type 2 diabetes. Screening for microalbuminuria in all patients with type 2 diabetes is recommended, as early treatment with CV risk reduction strategies is critical. Furthermore, the advantages of lowering blood pressure and blockade of the renin-angiotensin system have been clearly demonstrated in clinical trials.
Acknowledgements

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References

