

Original Article

Metabolic syndrome: recent prevalence in East and Southeast Asian populations

Paul Nestel MD¹, Ramon Lyu PhD², Lip Ping Low MD³, Wayne Huey-Hernig Sheu MD⁴, Wannee Nitiyanant MD⁵, Ikuo Saito MD⁶ and Chee Eng Tan MD⁷

¹Baker Heart Research Institute, Melbourne, Australia

²Worldwide Outcomes Research, Merck & Co., Inc

³Mt Elizabeth Medical Centre, Singapore

⁴Taichung Veteran's General Hospital, Taiwan ROC

⁵Siriraj Hospital, Bangkok, Thailand

⁶Keio University, Tokyo, Japan

⁷Gleneagles Medical Centre, Singapore

Background: The prevalence of the metabolic syndrome among a number of Asian populations as defined by several current criteria has been increasing rapidly and appears to resemble that among Western populations.

Methods: We review 25 surveys of the metabolic syndrome in Asian populations (PR China, Hong Kong, Taiwan, Japan, Philippines, Singapore) that report adequate information published during the last 5 years.

Results: Using Asian-adapted definitions of obesity (BMI ≥ 25 kg/m²) and increased waist circumference (for male ≥ 90 cm; for female ≥ 80 cm) prevalence appears to be between 10 to 30%. Those with the syndrome are more likely to have a history of diabetes and cardiovascular disease. The risk of developing Type 2 diabetes is 10 times higher among middle-aged Japanese men with the metabolic syndrome compared to healthy subjects. In Chinese and Japanese populations, people who have the metabolic syndrome are 3 to 10 times more likely to develop cardiovascular disease. Variance in prevalence estimates of the metabolic syndrome even within the same country result from differences in sampling and possibly from definitions.

Conclusions: The outstanding conclusion from recent surveys across the Asian-Pacific region is that of a consistent increase in the prevalence of the metabolic derangements associated with abdominal adiposity that lead to high risk of morbidity and mortality.

Key Words: metabolic syndrome, epidemiology, East and Southeast Asia, cardiovascular disease

Introduction

The metabolic syndrome, characterized by a constellation of individual cardiovascular disease risk factors including dyslipidemia, elevated blood glucose, hypertension and obesity is recognized as a major looming epidemic of the 21st century. The associations between the above metabolic components have been given the term "metabolic syndrome" possibly first in 1981.¹ A key issue is whether the associations were coincidental. However clustering of dyslipidemia, hyperglycemia, hypertension with adiposity appears to occur more frequently than by chance.^{2, 3} The World Health Organization (WHO) released a working definition of the metabolic syndrome.⁴ The United States National Cholesterol Education Program published criteria for the clinical diagnosis of the metabolic syndrome (NCEP ATP III) and provided recommendations on managing related risk factors.⁵

In the US, the prevalence of the metabolic syndrome in the adult population (aged 20 years and above) was estimated to be more than 25% using the WHO definition and to range from 22% to 24% using the ATP III definition.⁶⁻⁸ Similarly, the prevalence of the metabolic syndrome according to the WHO definition in seven European countries

was estimated to be 23%.⁹ In Canada, more than a quarter of the population between the ages of 35 to 75 years was affected by the metabolic syndrome based on the ATP III criteria.¹⁰ At least 12% of the population aged 25 years and above was found to have three or more risk factors in Australia.¹¹

The importance of the syndrome among Asian populations is fully recognized but it is not clear whether the prevalence has approached that in Western populations nor whether the prevalence varies substantially across the populations in the region. This paper summarizes the recent evidence in selected East and Southeast Asian populations, particularly as defined by WHO or NCEP ATP III criteria although corrections that account for the different definitions of overweight and obesity have often been included.

Corresponding Author: Dr. Paul Nestel, Baker Heart Research Institute, P.O. Box 6492, St Kilda Central, Melbourne, 8008, Australia.

Tel: (613) 8532 1383; Fax: (613) 8532 1100

Email: paul.nestel@baker.edu.au

Manuscript received 3 July 2006. Accepted 11 October 2006.

The recently published evidence that has been based on criteria used for Western populations allows for a comparison of the respective prevalence rates in Asia and Non-Asian affluent populations and the data based on criteria that best describe Asian populations have led to a truer evaluation of the problem.

Methodology

Twenty five surveys on the Asian prevalence of the metabolic syndrome published in the last five years have been accessed and included provided the data base was sufficiently large and the data adequately analyzed for valid conclusions to be drawn. However, as summarized below, consistency in selection criteria was variable.

Some published reports were based on the population of a specific city or region of a country or on highly selected groups such as company employees. Several studies reported the prevalence of people who had multiple cardiovascular disease risk factors including adiposity but were not based on either the WHO or the ATP III definitions.¹²⁻¹⁴ Interestingly, when both definitions were applied separately, the number of people with the metabolic syndrome identified by the WHO definition appeared to be greater than the number estimated using the NCEP ATP III definition. Since there have been no publications that have analyzed prevalence by the recently revised International Diabetes Federation (IDF) criteria¹⁵ that defines abnormal plasma glucose concentration as 5.6mmol/L or greater, the currently available rates are lower than had the new criterion for glucose been considered.

A common adaptation is the use of treatment status in identifying people with abnormalities of blood pressure and blood glucose in addition to recommended inclusion criteria.^{14,16-20} Some estimates were based on the presence of variable numbers of individual metabolic components^{21, 22} whereas estimates for China²³ have been based on a mixed definition adapted from both the WHO and the NCEP ATP III criteria.^{24,5}

Results

Table 1 summarizes the prevalence of the metabolic syndrome in selected East and Southeast Asian populations

using the NCEP ATP III definitions, selected primarily on the basis of homogeneity in the definition used. Overall, the prevalence is not markedly dissimilar across the various countries with their differing ethnic backgrounds and differing cultures. On that definition, that is more appropriate to Americans than to Asians, the prevalence of the metabolic syndrome is lower among Asians at least as reported in 2004. However, since the proportion and the distribution of body fat of Asians differ from that of Caucasians²⁵ so that a lower BMI (body mass index) among Asians corresponds to a higher percentage of body fat²⁵⁻²⁹ prevalence rates have been also calculated according to Asian-adapted definitions of obesity (BMI ≥ 25 kg/m²) and above normal waist circumference.^{14, 17-19, 30-32} Thus the estimated prevalence of the metabolic syndrome among adults in Kinmen increased from 15% to more than 21% when Asian rather than ATP III criteria were used for abdominal obesity.¹⁸ Similarly, using Asian criteria for abdominal obesity, the prevalence rates of the metabolic syndrome for both men and women increased in Singapore, Philippines, and Hong Kong from about 12%, 14%, and 17% to 18%, 19%, 22%, respectively.^{14,32,19} Among an urban Chinese population aged 30 to 74 years, the prevalence of the metabolic syndrome increased from about 10% to more than 26% when Asian criteria for abdominal obesity were applied.¹⁶ Similar observations were made in South Korean populations.^{30,31} Among elderly Chinese living in Beijing the respective prevalence rates for the metabolic syndrome, as defined by the ATP III and the IDF criteria were 30.5% and 46.3%; women having about twice the rate in men.³³ The lower plasma glucose level by the IDF criteria will lead to substantially higher prevalence rates.

These important comparisons are shown in Table 2.

Discussion

With the more appropriate definitions the overall prevalence of the metabolic syndrome in various Asian populations is probably only a little less than that in developed western societies. However, the difference in the prevalence rate is less than had been believed until the recent data, as summarized in this paper were published. Furthermore it is possible that the prevalence remains

Table 1. Prevalence of the metabolic syndrome in selected East and Southeast Asian populations by NCEP ATP III definition*

Population	Subjects (age, yr)	Prevalence by sex†	Reference
South Korea	8650 (20 - 79)	M: 14.2%; F: 17.7%	43
South Korea	40,698 (20 - 82)	M: 5.2%; F: 9%	30
South Korea	655 (30-80)	M: 16%; F: 10.7%	31
China	2048 (20-70)	M: 8.8%; F: 13.3%	44
China	1839 (30-74)	All: 10.1%	16
China	14,690 (35 -74)	All: 17.2%‡	34
Singapore	4723 (18 - 69)	M: 13.1%; F: 11%	14
Taiwan	8320 (30 - 92)	M: 11.2%; F: 18.6%	18
Hong Kong	2893 (25 - 74)	M: 15.3%; F: 18.8%	19
Philippines	4541 (>20)	M: 14.3%; F: 14.1%	32

* Definition used in these studies was the NCEP ATP III (5). † M (male); F (female).‡ Defined as 3 or more of overweight, dyslipidemia, hypertension, diabetes, cigarette smoking. † Defined as 3 or more of overweight, dyslipidemia, hypertension, diabetes, cigarette smoking.

Table 2. Prevalence of metabolic syndrome by NCEP ATP III definition* and the Asian adapted definition*.

Population (reference)	Prevalence by ATP III	Prevalence by Asian
South Korea (30)	M: 5.2%; F: 14.4%	M: 9.8%; F: 12.4%
South Korea (31)	M: 16%; F: 10.7%	M: 29%; F: 16%
China (16)	All: 10.1%	All: 26.3%
Singapore (14)	M: 13.1%; F: 11%	M: 20.9%; F: 15.5%
Taiwan (18)	M: 11.2%; F: 18.6%	M: 23.8%; F: 17.7%
Hong Kong (19)	M: 15.3%; F: 18.8%	M: 20.2%; F: 23.6%
Philippines (32)	M: 14.3%; F: 14.1%	M: 18.6%; F: 19.9%

* NCEP ATP III definition (5); Asian adaptation (20)

underestimated in Asian populations due in part to variations in the definition of the syndrome and to selection biases in sample populations. However, prevalence estimates of the metabolic syndrome in populations in newly developed economies such as Hong Kong and Taiwan have begun to resemble that in western countries. Evolution towards a more westernized society characterized by overabundance in energy intake, lack of physical activities and urbanization seems to have had the same impact on the prevalence of the metabolic syndrome in Asians as has occurred in western countries. A recent report on the prevalence of cardiovascular risk factors that define the metabolic syndrome among 14,690 adults in China has provided a further robust comparison.³⁴ Overall, 80.5%, 45.9% and 17.2% of Chinese had one or more, two or more and three or more risk factors that included dyslipidemia, hypertension, diabetes, overweight and smoking. This corresponded with 93.1%, 73% and 35.9% prevalence among American adults for the same risk factor clusters. The significance of the difference in body fat distribution between Caucasians and Asians had been until recently a factor in underestimating the respective prevalence rates.^{35,36}

On the other hand, among different ethnic populations living in the same country the prevalence of the metabolic syndrome has been found to vary. For example, the prevalence among Canadian Chinese was found to be much lower (11%) when compared to that of Canadians from other ethnic groups such as aboriginal Indians (42%), South Asians (26%), and Europeans (22%).¹⁰ Even among Asians, residents in Singapore with a Chinese ancestry have a lower prevalence of the metabolic syndrome compared to that of residents with Malay or Indian ethnic origins.¹⁴ Clearly the interactions of environmental and genetic factors remain important determinants of the phenotypic expression of the metabolic syndrome.

Data regarding the association between the metabolic syndrome, conversion to diabetes and the risk of cardiovascular disease are not well documented in most countries in the region. Among Asian, American, and Scandinavian patients with diabetes, most share the components of the metabolic syndrome: dyslipidemia and hypertension. However in Asian populations, hypertension is a more frequent abnormality than in Caucasians.^{14, 37} The risk of developing type 2 diabetes in seven years is more than 10 times higher among middle-aged Japanese men who have the metabolic syndrome compared to those without any components of the syndrome.²⁰

Adult Koreans with the metabolic syndrome are more likely to have a history of cardiovascular disease (increased risk estimates vary from 15% to three-fold) when compared to those without the syndrome.¹⁷ Furthermore, in Chinese and Japanese populations, people who have the metabolic syndrome are 3 to 10 times more likely to develop cardiovascular disease in the future.^{16, 38, 20} The odds ratios for cardiovascular risk will also be influenced by the definition of the syndrome. Thus, among the elderly Chinese, the odds ratio for coronary heart disease, stroke and peripheral artery disease in those with the metabolic syndrome were 1.43, 1.45 and 1.47 by the ATP-III criteria and 1.69, 1.58 and 1.42 using the IDF criteria.³³ These findings are in agreement with studies conducted in American and European populations showing that the metabolic syndrome is associated with a 2 to 3 times increase in the likelihood of coexisting coronary heart disease and stroke as well as a 30% to almost 4-fold rise in the risk of developing cardiovascular disease, especially coronary heart disease.³⁹⁻⁴¹

Conclusions

The prevalence of the metabolic syndrome in selected populations in East and Southeast Asia seems to be within the range of the estimated prevalence among Western populations according to existing data. However, due to the lack of standards in defining the metabolic syndrome and potential sampling bias, the variance of prevalence estimates is large even within the same country.

Despite the lack of standardization in the definition, if 10 to 20% of the adult population in the region suffers from the metabolic syndrome the absolute number of affected individuals would roughly range from 130 million to 260 million. Asian populations are expected to experience escalating rates of obesity, dyslipidemia, elevated blood glucose, hypertension and diabetes, exemplified by the prevalence of obesity among children in the region with almost half of preadolescent overweight or obese children having the metabolic syndrome in Hong Kong.⁴²

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⁴*Taichung Veteran's General Hospital, Taiwan ROC*

⁵*Siriraj Hospital, Bangkok, Thailand*

⁶*Keio University, Tokyo, Japan*

⁷*Gleneagles Medical Centre, Singapore*

代謝症候群：當前東亞及東南亞人口的盛行率

背景：以幾個目前代謝症候群的標準定義，顯示在亞洲人口的代謝症候群盛行率已經快速增加，且與西方族群相似。

方法：我們查證 25 個調查亞洲族群(中國大陸、香港、台灣、日本、菲律賓、新加坡)代謝症候群之研究，這些都是近五年的報告並有足夠的訊息。

結果：使用適用於亞洲人的肥胖定義(BMI ≥ 25 kg/m²)及腰圍(男性 ≥ 90 cm；女性 ≥ 80 cm)，盛行率呈現在 10-30%之間。有症候群的人，大部份有糖尿病及心血管病史。有代謝症候群的日本中年男性罹患第二型糖尿病的危險性較健康的人高出十倍以上。在華人及日本人中，有代謝症候群者有 3-10 倍的機會可能發展成心血管疾病。即使在同一個國家，估計代謝症候群盛行率的變異可能來自抽樣的差異及不同的定義。

結論：從近期橫跨亞太地區的調查得到的重要結論為，各國的與腹部肥胖有關的代謝紊亂盛行率呈現一致上升的趨勢，將導致罹病率與致死率危險上升。

關鍵字：代謝症候群、流行病學、東亞及東南亞、心血管疾病。