Factor Analysis of Metabolic Syndrome in Aged Population Undergoing Periodical Health Examinations

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Abstract

Background: Metabolic syndrome (MetS) is a common health problem in aged people. The cluster of diseases associated with MetS, namely, heart disease, cerebrovascular disease, diabetes, hypertensive disease and renal disease, had made a death rate of 0.17%, higher than 0.15% attributed to cancers.

Aims: To investigate the prevalence, incidence and reversion rate of MetS in Aged population undergoing periodical health examinations, as well as the associated impact factors.

Results: The prevalence of MetS was found to be 19.9% among all the subjects studied, to be higher in female (23.1%) than in male (18.3%). The incidence of MetS was 17.6%. In contrast, the reversion rate of MetS was 45.0%. Sex ($p = 0.045$) and history of hyperlipidemia ($p = 0.006$) were two factors found to be significantly associated with the reversion rate of MetS.

Conclusion: Physical examinations may help early detect diseases and revise high risk factors timely. Compared with the ordinary older population, those undergoing periodical health examinations tended to have lower incidence of MetS, better health status and higher disease reversion rate than incidence. To sum up, individualized health education and guidance is an imperative and critical nursing intervention to ensure a healthy state for aged population.

Keywords: metabolic syndrome, aged, health examinations

1. Introduction

Metabolic syndrome (MetS) is a common health problem in aged people. According to the report of the top 10 causes of death issued by the Ministry of Health and Welfare of Taiwan in 2017, the cluster of diseases associated with MetS, namely, heart disease, cerebrovascular disease, diabetes, hypertensive disease and renal disease, had made a death rate of 0.17%, higher than 0.15% attributed to cancers. MetS is significantly associated with chronic diseases. Compared with non-MetS patients, MetS patients run1 to 4 times higher risks of cardiovascular disease and diabetes. Diabetic patients with MetS make 4.9 times higher incidence of cardiovascular disease than those without MetS (Montazerifar, Bolouri, Mahmoudi Mozaffar, & Karajibani, 2016). Patients with MetS also have higher risk of colorectal cancer, breast cancer, pancreatic cancer, prostate cancer, and gastric cancer (Hu et al., 2017; Uzunlulu, Telci Caklili, & Oguz, 2016). The prevalence of MetS tends to increase with age. A systematic literature review on the prevalence of MetS among the Asian Pacific adults yielded the result of 16.5% (17.2% in male v.s.16.0% in female) in Japan. In Taiwan, it was 25.5% (25.5% in male vs. 31.5% in female), and tended to continuously run up high (Ranasinghe, Mathangasinghe, Jayawardena, Hills, & Misra, 2017). Another research suggested the MetS prevalence of 29.0% in the older population in Taiwan (21.6% in male v.s. 38.2% in female) (Abbasi-Ghahramanloo, Soltani, Gholami, Erfani, & Yosaee, 2016). In Iran, the adult prevalence of MetS was 49.5% (40.2% in male vs. 55.9% in female) (Montazerifar et al., 2016). In the US, the prevalence was higher than 25% (Abbasi-Ghahramanloo, Soltani,

Gholami, Erfani, & Yosaee, 2016), while in Amsterdam, the prevalence and incidence of community residents aged 55 to 85 years were 37% and 30%, respectively (Van Ancum et al., 2018).

MetS is defined as at least three of the following metabolic risk factors to be diagnosed with: waist circumference (≥ cm for males, ≥ 80 cm for females), blood pressure (systolic ≥ 130 mmHg or diastolic ≥ 85 mmHg), fasting blood glucose ≥ 100 mg/dL, HDL-C (< 40 mg/dL for males, < 50 mg/dL for females), and triglyceride >150 mg/dL (Montazerifar et al., 2016). Other compound factors are old age, higher BMI, living with family members, lower level of education, lack of physical exercise, female, obesity, and family history (Franca, Lima, & Vieira, 2016; Lin et al., 2015; Montazerifar et al., 2016; Roos et al., 2017). Predictors of MetS in community older adults include heart disease, peripheral artery disease, diabetes, cerebral stroke and higher BMI (Van Ancum et al., 2018).

On the other hand, healthy lifestyle such as habits of sufficient exercise, abstinence from smoking and betel nut chewing, and well-controlled dietary pattern is statistically associated with low incidence of MetS (Leonie et al., 2014). Pritikin's research (2018) suggested that compared with taking medications, health education and lifestyle changes were more effective in reversing MetS. Healthy diet and regular exercise had 2 to 1/2 times higher effect than medications in elimination of MetS. Health management and education may enhance our self–awareness and determination to take actions to change behaviors such as doing more exercise and keeping on healthier diet to promote our own health (Lo, Chair, & Lee, 2015). Going on a diet and control of weight are beneficial for the reversion of MetS (Ferland & Eckel, 2012).

Taipei Veterans General Hospital has on a regular basis provided the chances of two-stage annual geriatric health examination for residents aged ≥ 65. Physical examination was performed at the first stage, followed by an OPD revisit 2 weeks later as the second stage for review of the results of examination and, if necessary, giving nursing guidance for abnormal items.Supposing that people willing to have health examination are better motivated to promote their own health, we performed this retrospective study to analyze, using the data from the health examination performed in 4 consecutive years from 2012 to 2015, to investigate the prevalence, incidence and reversion rate of MetS, as well as the associated impact factors, for reference to more effective nursing health education in the future.

2. Method

2.1 Research Design

This cohort study adopted retrospective data analyses.

2.2 Participants

Participants were the residents of the Taipei City aged ≥ 65 to have the geriatric health examinations in Taipei Veterans General Hospital for 4 successive years between 2012 and 2015.The geriatric health examination was performed at two stages, the physical examination was conducted at the first stage, followed by an OPD revisit 2 weeks later as the second stage for review of the results of the examinations aided by a physician and giving health education and guidance for abnormal items. The participants who had MetS were given with guidelines for care of metabolic syndrome, the contents of which included diagnosis of MetS, how to make periodic surveillance, diet adjustments, exercise, abstinence from smoking and cigarettes, and relief of stress.

2.3 Data Collection

The results of the geriatric health examinations drawn between 2012 and 2015 from the EMD database in Taipei Veterans General Hospital were collected. Variables collected included age, sex, identity, exercise habit, medical history and medication history. The study complied with research ethics guidelines and was reviewed and approved by the Institutional Review Board of the hospital (IRB No: 2017-05-007BC)

2.4 Data Analysis

The data were keyed in using Excel in an anonymized encoding process. The statistical software SPSS 20.0 (IBM SPSS Inc. Chicago Illinois) was used for multiclass classification, percentage, and order. The Chi-square test was used to determine the association of age, sex, identity (veterans or non-veterans), exercise habit, medical history and medication history with the prevalence, incidence and reversion rate of MetS.

3. Results

3.1 Sample Characteristics

The participants enrolled were aged ≥ 65 (average: 75.8 yrs) in their first year for entrance into the study. There were more male participants (n=226, 55.1%) than females (n=184, 44.9%), and more veterans (n=238, 58%)

than non-veterans (*n*=172, 42%). Among totally 410 paticipants, 74.9% (*n*=307) had a habit of taking exercise more than 150 min per week, 77.6% (*n*=318) were with hypertension history, 14.1% (*n*= 58) had the history of hyperlipidemia, and 10.7% (*n*=44) had history of hyperglycemia; 46.3% (*n*=190) took antihypertensive agents, and 13.2% (*n*=54) took antihyperlipidemic agents. No one took antihyperglycemic agents (Table 1).

Table 1. Demographic information related to incidence rate and reversion rate (*N*=410)

Independent vavariables		*n*	(%)	Incidence rate**				Reversion rate***			
				p Value	95% CI			*p* Value	95% CI		
Age		65-95 (mean=75.8)		0.257	0.555	-	1.170	0.918	0.967	-	1.031
Sex	Male	226	(55.1)	0.546	0.963	-	1.020	0.045*	0.421	-	0.991
	Female	184	(44.9)							-	
Identity	Veteran	238	(58.0)	0.851	0.673	-	1.386	0.463	0.774	-	1.757
	Non-veteran	172	(42.0)								
Habit of Exercise	N/A	103	(25.1)	0.563	0.557	-	1.374	0.244	0.730	-	1.083
	More than 150 min per week	307	(74.9)								
Medical history	Hypertension(Yes/No)	318	(77.6)	0.052	0.996	-	2.603	0.667	0.657	-	1.928
	Hyperglycemia(Yes/No)	44	(10.7)	0.379	0.692	-	2.630	0.082	0.943	-	2.670
	Hyperlipidemia(Yes/No)	58	(14.1)	0.260	0.755	-	1.079	0.006*	1.309	-	5.033
Medication	Hypertension(Yes/No)	190	(46.3)	0.556	0.777	-	1.599	0.454	0.782	-	1.732
	Hyperglycemia(Yes/No)	0	0.0								
	Hyperlipidemia(Yes/No)	54	(13.2)	0.782	0.451	-	1.821	0.092	0.254	-	1.109
Constant				0.438				0.106			

*P < 0.05

PS:

** Incidence rate: Number of new cases of MetS in current year / Number of health examinations in current year X 100%

***Reversal rate: Number of cases who had MetS last year but have no MetS in the current year in health examination / Number of health examinations in current year X 100%

3.2 Prevalence, Incidence, and Reversion Rate of MetS

Prevalence is all existing cases number of health examinations of MetS divided by number of health examinations in current year. The average prevalence of MetS was 19.9%, to be 14.2%, 22.2%, 18.8%, and 24.4% in sequence of year. The average prevalence by sex was 18.27% in male and 23.1% in female. Average incidence was 17.6%, to be 14.4%, 19.6%, 14.1%, and 22.2% in sequenceof year; average reversion rate was 45.0%, to be 13.8%, 39.6%, 76.6%, and 50.0% in sequence of year (Table 2, Table 3).

Table 2. Prevalence, incidence & reversion rate of MetS, by year (*N*=410)

Year	Subjects (a)	MetS (b)	Prevalence (c=b/a)	Population at risk (d=a-b)	*Incidence event (e)	Incidence yearly (f=e/d)	**Reversion event (g)	Reversion rate (h=g/b)
2012	410	58	14.2%	402	58	14.4%	8	13.8%
2013	410	91	22.2%	352	69	19.6%	36	39. 6%
2014	410	77	18. 8%	319	45	14.1%	59	76.6%
2015	410	100	24.4%	333	74	22.2%	50	50.0%
Average			19.9%			17.6%		45.0%

PS:

* Incidence event: Number of new cases of MetS in current year in health examination.

** Reversion event: Number of cases who had MetS last year but have no MetS in the current year in health examination

Table 3. Prevalence of MetS, by sex

Year	Male			Female		
	No. of subjects (a)	No. with MetS (b)	Prevalence (c=b/a)	No. of subjects (d)	No. with MetS (e)	Prevalence (f=e/d)
2012	226	26	11.5%	184	32	17.4%
2013	226	45	19.9%	184	46	25.0%
2014	226	35	15.5%	184	42	22.8%
2015	226	51	22.6%	184	50	27.2%
Average			18.3%			23.1%

3.3 Relevant Impact Factors

The correlations of the prevalence, incidence and reversion rate of MetS with variables such as sex, age, identity (veterans or non-veterans), habits of exercise, medical history and medication history were determined.

However, except that the reversion rate of MetS was found to be statistically correlated with sex and hyperlipidemia history ($P< 0.05$), no other variables showed to be the predictive factors in affecting either incidence or reversion rate of MetS.

4. Discussion

This study demonstrated that the prevalence of MetS in our aged participants ranged 14.2 – 24.4% at an average of 19.9% in four years, which is lower than 29.0% as shown in other previous research on the older adults in Taiwan region and 25% in the US as found by Abbasi-Ghahramanloo (Abbasi-Ghahramanloo et al., 2016), and even far lower than the 37% as suggested by Van (Van Ancum et al., 2018). Our obviously better results might have to do with the stronger motivation of those who were willing to have health examination to maintain their health, and good habit of regular exercise. Both indicated healthy lifestyle behaviors.

The present study evidenced different prevalence of MetS in males (18.27%) from females (23.1%). Similar results were also found by Abbasi-Ghahramanloo (21.6% in males vs. 38.2% in females) and by Montazerifar et al. in 2016 (40.2% in males vs. 55.9% in females). The clearly higher prevalence of MetS in females than in males was supposed to result from the lower metabolic rate with increased body fat percentage in postmenopausal women.

The prevalence of MetS from 14.2% in 2012 to 24.4% in 2015 showed a climbing trend similar between male and female, which conformed with the findings of Ranasinghe et al.(2017), Montazerifar et al. (2016) and Franca et al. (2016). The incidence of MetS calculated from the present study (14.1% - 22.2%, average: 17.6%) was much lower than the value of 30% as suggested by Van et al. (2018). In Van's research, hypertension, hyperlipidemia and diabetes were found to be predictors of MetS, whereas relatively fewer participants with hyperglycemia (10.7%) and hyperlipidemia (14.1%) in our study made it difficult to draw any significant conclusion. Nevertheless, the incidence of MetS showed a trend rising from 14.2% in 2012 to 24.4% in 2015, similar to that of the prevalence of MetS. The reversion rate of MetS also tended to increase from 13.8% in 2012 to 50.0% in 2015. Health education and guidance provided concomitantly with the health examination was supposed to take some effect on improving their health status, in viewing that people willing to have regular health examinations should have stronger motivation to maintain or manage a better and healthier life.

The Chi-square test was used to determine the association of incidence and reversion rate of MetS with sex, identity, habit of exercise, medical history, and use of medications. Incidence of MetS showed to be associated with none of the above-mentioned independent variables, which was different from the results found by several researchers indicating the association of the incidence of MetS with sex, age, healthy lifestyle and medical history. Although our study found higher incidence of MetS in older age and female subjects, it made no statistically significant difference.

The reversion rate of MetS in the present study was found significantly associated with sex and history of hyperlipidemia ($p < 0.05$). The association of reversion rate and sex could be readily attributed to the better compliance inhertied in behaviors of females than males. To our surprise, we did not find an association between regular exercise of 150 min/week and reversion rate.

According to the studies of Pritikin (2018) and Lo et al. (2015), healthy lifestyle is the most favorable factor for reversion of MetS, while Ferland & Eckel (2012) suggested that going on a diet and maintaining weight loss facilitate the reversion of MetS. The absence of findings to confirm the association between regular exercise and reversion of MetS in this study was supposed to have something to do with the successful health eduation provided at the second stage after health examination against the abnormal results. The information related to the causes of MetS, as well as health guidelines on how to keep a healthy lifestyle such as appropriate diet and proper exercise might also take some effect on pushing them into a healthier lifestyle than before.

In the present study, 77.6% of the subjects were with the history of hypertension, 46.3% took medication; and 14.3% were with hyperlipidemia, 13.2% took medication, which suggested that medication control be the primary cause for reversion of the diseased state. The failure in finding the association between regular exercise and reversion rate remained unkown, although it might possibly be ascribed to the ambiguous classification of sports types.

5. Conclusion

This was a long-term study for tracing MetS from 2012 to 2015 in older population aged ≥ 65 (agerage:75.8 yrs). The majority of them were male (55.1%), and veterans (58.0%). In a total of 410 subjects, 74.9% had an exercise habit of 150 min per week, 77.6% were with history of hypertension history, 14.1% were with hyperlipidemia, and 10.7% were with hyperglycemia; 46.3% took antihypertensive agents, 13.2% took antihyperlipidemic agents.

The incidence was 17.6% on average, and was elevated with age; reversion rate was 45.0% on average, and decreased with age. The reversion rates of MetS was statistically significantly associated with sex ($p = 0.045$) and hyperlipidemia history ($p = 0.006$). Physical examinations may help early detect diseases and revise high risk factors timely. Compared with the ordinary older population, those undergoing periodical health examinations tended to have lower incidence of MetS, better health status and higher disease reversion rate than incidence. To sum up, individualized health education and guidance is an imperative and critical nursing intervention to ensure a healthy state for aged population.

6. Study Limitation and Recommendation

This 4-year study might have the advantages of data collected on a long-term follow-up basis to predict a comparatively enduring trend of health status in aging population. However, limitations are enevitable since we used the data from database, which hindered us from collecting other useful data that were lack in the database, for examples, parameters related with healthy lifestyle such as dietary status, habits of smoking or drinking, etc… Health education had a positive impact on reinforcing healthy promotion behaviors.

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