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Work-related Cerebrovascular and Cardiovascular Diseases (WR-CVDs) in Korea

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Abstract: The effects of work on the heart are mediated by chemical, physical, and psychological stressors. It is standard clinical practice to assess personal risk factors such as cigarette smoking, hypertension, and cholesterol. Evaluation of a patient's acute symptoms and activity level at the time of presentation is also standard practice. However, clinicians typically do not assess workplace risk factors; nor do they usually identify the location and its possible exposures that may have contributed to the patient's symptoms. In Korea, work-related cerebrovascular and cardiovascular diseases (WR-CVDs) are among the most compensated cases, second only to work-related musculoskeletal disorders (WR-MSDs). The average accumulated insurance benefit per injured worker is an estimated USD 75,000, which is thought to have a major impact on the financial stability of insurers. Therefore, the present study was performed to 1) review the physicochemical agents of cardiovascular diseases in Korea, 2) review the effects of psychosocial factors such as work-related stress on WR-CVDs in Korea, and 3) discuss the concepts and perspectives of WR-CVDs in Korea by comparing with those in Japan.

Key words: Work-related disease, Cerebrovascular disease, Cardiovascular diseases, Korea, Japan

Introduction

The effects of work on the heart are mediated by chemical, physical, and psychological stressors. All too often, however, clinicians and researchers overlook the potential link between work and a cardiovascular event.

It is standard clinical practice to assess personal risk factors such as cigarette smoking, hypertension, and cholesterol. Evaluation of a patient's acute symptoms and activity level at the time of presentation is also standard practice. However, clinicians typically do not assess workplace risk factors; nor do they usually identify the location and its possible exposures that may have contributed to the patient's symptoms[1)]. Therefore, cardiovascular diseases are scarcely recognized as work-related diseases on a world-wide basis.

Cardiovascular diseases resulting from physicochemical agents encountered in the workplace (e.g., carbon disulfide, carbon monoxide, or extreme heat) are generally recognized as work-related conditions in many industrialized countries. In Korea, work-related cerebrovascular and cardiovascular diseases (WR-CVDs) due to overwork are predominantly recognized as work-related under the Industrial Accident Compensation Act. Thus, WR-CVDs refer to overwork-related cardiovascular diseases rather than physicochemical factor-induced diseases. In Korea, psychosocial factors such as overwork account for most cases of WR-CVDs, whereas physicochemical factor-induced WR-CVDs account for only a very small portion of cases. Japan, Taiwan, and South Korea are the only countries in the world that recognize cardiovascular and cerebrovascular diseases due to psychosocial factors (e.g., overwork) as WR-CVDs and

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Table 1. Typical cases of occupational cardiovascular disease in Korea due to physicochemical factors, according to the Occupational Health Safety Research Institute (OSHRI)

Year	Diseases	Hazards	Industry
1995	Ischemic heart disease	Heat	Glass manufacturer
2001	Arrhythmia	Toluene	Printing
2001	Ischemic heart disease	Carbon monoxide	Boiler working
2001	Dilated cardiomyopathy	Carbon monoxide	Electronic smelting
2002	Congestive cardiomyopathy	Carbon monoxide	Wastes treatment
2002	Myocardial infarction	Nitroglycerin	Explosives storing
2003	Atrial fibrillation	1,1,1-trichloroethane	Mechanic machine manufacturing
2008	Myocardial infarction	Heat	Rubber tire manufacturer

Source: Database on recognized occupational diseases by OSHRI.

compensate employees accordingly[2].

A variety of confounding factors make it difficult to compare the compensation of occupational disease in multiple countries. First of all, the patterns of occupational disease are closely linked to the industrial development of a country. For instance, the pattern of disease depends on the industries developed in a particular country, as well as the chemical hazards prevalent in that country. Secondly, the diagnosis of occupational disease is easily influenced by the state of occupational medicine or industrial hygiene in a particular country. Thirdly, social issues or socio-cultural values may play a role in a country's decision to compensate employees for occupational diseases. Finally, the compensation of work-related diseases is influenced by a nation's occupational health, social security, and health insurance programs. Therefore, the compensation of occupational diseases in various countries must be carefully and comprehensively compared.

The present study was performed to 1) review the physicochemical agents of cardiovascular diseases in Korea, 2) review the effects of psychosocial factors such as work-related stress on WR-CVDs in Korea, and 3) discuss the concepts and perspectives of WR-CVDs in Korea by comparing with those in Japan.

Methods

We conducted a search of the PubMed and KoreaMed databases with search word "work/occupation", "cardiovascular disease", "cerebrovascular disease" and "Korea" to identify reports of occupational heart disease or WR-CVDs in Korea that were published through December 2009. We then reviewed all relevant papers and corresponding references published in Korean and English. Pertinent reports of occupational neurologic disorders in Korea were also included in our analysis.

In addition, we conducted a thorough review of the electronic database of occupational diseases maintained by the Korean Worker's Compensation and Welfare Service (COMWEL).

Results and Discussion

Typical cases of occupational cardiovascular disease due to physicochemical factors

Physicochemical risk factors encountered in the work environment that may induce or aggravate acute cardiovascular abnormalities such as arrhythmia, angina, myocardial infarction, and sudden death include carbon monoxide[3–5], methylene chloride[6], nitrates such as nitroglycerin[7], solvents[8–11], pesticides[12], fluorocarbons and hydrocarbons[13], and cold and heat[14].

Table 1 describes several typical cases of occupational cardiovascular disease in Korea due to physicochemical factors, according to the Occupational Health Safety Research Institute (OSHRI), KOSHA. According to the OSHRI, which is equivalent to the United States National Institute of Occupational Safety and Health (NIOSH), has conducted in-depth assessments of the work-relatedness of particular cardiovascular diseases, chemical hazards (e.g., toluene, carbon monoxide, nitroglycerin, or 1,1,1-trichloroethane) and physical hazards (e.g., heat) induced or affected occupational cardiovascular diseases. Recently, workers of a tire manufacturer began to report an increase in cardiovascular diseases, and some of these cases turned out to be work-related. These cases remind us of the importance of physical factors in relation to work-related cardiovascular diseases.

WR-CVDs due to overwork

With the exception of congenital heart disease, stroke and ischemic heart diseases (including dissecting aortic aneurysm) that are aggravated or precipitated by occupational factors are recognized as work-related diseases in Korea.

In Korea, WR-CVDs are among the most compen-

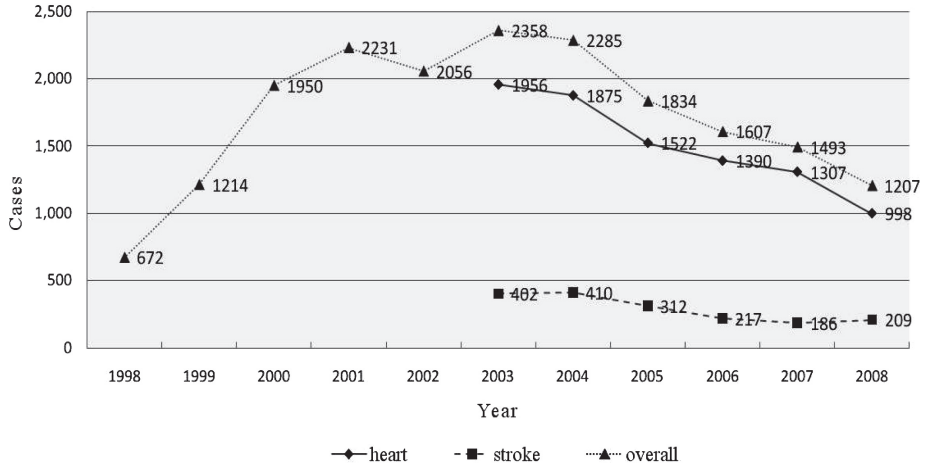

Fig. 1. WR-CVDs in Korea (1998–2008). The total number of employees was 13,489,986 in 2008.

sated cases, second only to work-related musculoskeletal disorders (WR-MSDs). The average accumulated insurance benefit per injured worker is an estimated USD 75,000, which is thought to have a major impact on the financial stability of insurers[15]. Since 1998, the number of workers suffering from WR-CVDs has significantly increased. According to data on compensation due to occupational diseases, WR-CVDs cases peaked in 2003 with 2,358 cases and now appear to be decreasing dramatically. The reasons for the decrease may be addressed as follows. First, the Ministry of Health & Welfare and the Ministry of Employment & Labor launched the extensive program for prevention of lifestyle-related diseases such as hypertension, diabetes mellitus, and hyperlipidemia etc. in general population and workers, respectively these 10 yr. Second, the legal weekly working hours in the Labor Standards Law was amended from 44-h to 40-h per week in 2004.

The possibility of work-relatedness should not be overlooked when physicians see patients with cardiovascular diseases in Korea.

The criteria of WR-CVDs in Korea

In 1978, WR-CVDs were compensated for the first time as work-related diseases in the scheme of workers' compensation in Korea. Initially, the Korean criteria for WR-CVDs was similar to that developed by the Japanese in 1961.

Until June 2008, the criteria for the diagnosis of WR-CVDs due to overwork were as follows. The first criterion allowed for a diagnosis of WR-CVDs in the event that an unusual episode such as extreme surprise or fear, unusually heavy physical exertion and episodes of violent anger occurred within 24 h prior to the onset of the disease (i.e., the first type). The second criterion allowed for a diagnosis in the event that the employee's workload or working hours increased by more than 30% for more than 3 d in a row before the onset of the disease (i.e., the second type). The third criterion allowed for a diagnosis in the event that workload, work hours, and employee tasks changed within 1 wk before the onset of disease, to the extent that an average employee could not adapt (i.e., the third type). In addition, hemorrhagic cerebrovascular disease was considered work-related if it occurred during working hours at the workplace and there were no evidence suggesting that it was caused by non-occupational activities.

The first type of WR-CVDs is considered acute injuries rather than disease. Work-related factors, such as unusual episode that occurred within 24 h prior to the manifestation of disease can be considered as trigger factors. There is scientific evidence to suggest that the natural history of coronary artery disease is punctuated by clinical manifestations of acute coronary syndrome due to triggers, such as heavy physical exertion[16, 17] and episodes of anger[18]. Therefore this type of WR-CVDs may be considered work-related even in other industrialized countries.

However, the second and third types of WR-CVDs were defined in Japan where occupational pressures have historically been higher than Korea and other developed countries. Moreover, Korea has revised certain elements of the criteria several times for administrative reasons and social pressures, without any scientific evidence supporting such modifications[19]. For instance, the term 'overwork' is a rather ambiguous concept. Thus, critics have argued that the determination of work-relatedness depended too heavily on subjective interpretations. Furthermore, it remains a topic of debate whether the workload or the working hours of the worker should be increased by more than 30% for more than 3 d in a row

before the onset of the disease (i.e., the second type); or whether the criteria should specify that workload, work hours, and the employee's tasks changed within 1 wk of the onset of the disease to the extent that the average employee cannot adapt (i.e., the third type); or whether the criteria should consider hemorrhagic cerebrovascular disease a work-related disease if it occurred at the workplace during the performance of the job[20].

The criteria for compensating Korean citizens for WR-CVDs was revised on July, 2008, as follows.

A. If a worker experiences intracerebral hemorrhage · subarachnoid hemorrhage · cerebral infarction · myocardial infarction · dissecting aneurysm of the aorta with any of the below-named causes, it will be considered a work-related disease. Conditions that result from natural pathological process will not be considered work-related.
   1) Situations that cause significant physiological changes in workers who have experienced unexpected accidental strain, agitation, fear, shock, or dramatic changes in work environment (i.e., the first type) just prior to the onset of disease.
   2) Situations that cause mental and physical exhaustion as a result of increased work load, working hours, work intensity, job responsibility or changes in work environment a brief periods before the onset of disease (i.e., the second type).
   3) Situations that cause mental and physical overload due to chronic overwork followed by a change in work load, working hours, work intensity, job responsibility, and work environment (i.e., the third type).
B. A condition can also be considered work-related if any cerebrovascular or cardiovascular diseases not mentioned above are triggered or aggravated in a chronological or medical manner.
C. Instructions necessary for the evaluation of work-relatedness according to A and B shall be prescribed by Notification of the Minister of Ministry of Employment & Labor.

The new compensation criteria categorizes WR-CVDs as those due to significant physiological changes after an unexpected accident just prior to the onset of disease (i.e., the first type), WR-CVDs due to mental and physical exhaustion during a brief period (i.e., the second type), and WR-CVDs due to chronic mental and physical overload (i.e., the third type).

In addition, the new compensation criteria in the Enforcement Decree of the Industrial Accident Compensation Insurance Act removed unreasonable language, such as 'workload or working hours of the worker increased by more than 30% compared with regular tasks for more than 3 d in a row before the occurrence of the disease (the second type)' as well as exceptional criteria in the old criteria regarding hemorrhagic cerebrovascular disease. To some extent, the new criteria are more reasonable than the old criteria. However, the concept of 'overwork' during short periods of time and the concept of chronic overload remain unclear and are not addressed by any guidelines; thus, these aspects make it difficult to determine the work-relatedness of a condition.

The comparison of the Korean criteria of WR-CVDs with Japanese criteria

We compared the Korean criteria with the Japanese criteria, which was revised in 2001[21]. The countries have very similar criteria regarding conditions of the first type; however, the Japanese criteria for the second type are clearer and more reasonable than the Korean criteria. The Japanese criteria limited the second type of WR-CVDs to situations of physiological collapse due to short periods of very significant overwork. Moreover, Korea and Japan approached chronic WR-CVDs (i.e., the third type) rather differently. Japan opted for more detailed and evidence-based compensation criteria that defines 'chronic overload' as '100 h overtime in the last month' or a 'monthly average of 80 h overtime during the last 2–6 months'. In that case, chronic overburden definitely prevents workers from attaining the minimum sleeping time (i.e., 4~6 h) needed to recover from fatigue, and leads to work-related cardiovascular diseases[22]. In contrast, Korea's new compensation criteria defines 'chronic mental and physical overload' as 'causing mental and physical overload due to chronic overwork followed by a change in work load, working hours, work intensity, job responsibility, and work environment' without any expository comment. We suggest that Korean criteria should have additional detailed guidelines in which the criteria should be set clearly in a more quantitative manner based on scientific evidences in near future.

The WR-CVDs based on scientific evidence and those based on compensation criteria may differ. Evidence is more important with regards to the prevention of occupational diseases. Further research is needed to determine the optimum number of working hours in Korea.

In summary, WR-CVDs may be induced or aggravated by physicochemical factors in the workplace. In addition, WR-CVDs may more often occur due to psychosocial factors, which can be categorized into three types. Therefore, physicians should consider the psychological and physicochemical factors of workplaces in patients who present with cardiovascular symptoms and signs.

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