

# Factors Affecting the Musculoskeletal Symptoms of Korean Police Officers

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**Abstract.** [Purpose] This study was conducted to investigate efficient, systematic management of the Korean police and to examine the status and prevention of musculoskeletal disorders in Korean police officers. [Subjects and Methods] A survey of police officers (353 subjects) who visited the National Police Hospital from March 2013 to May 2013 was conducted using a structured questionnaire. [Results] The incidence of pain was 44.2% in the shoulder, 41.4% in the waist, 31.2% in the neck, 26.1% in the legs/foot, 16.7% in the hand/wrist/finger, and 14.7% in the arm/elbow. The comparative risk of the relevant part factors was analyzed by multiple regression analysis. The shoulder had a 4.87 times higher risk in police lieutenants compared with those under the rank of corporal and a 1.78 times higher risk in people with chronic diseases than those without chronic diseases. The arm/elbow had a 2.37 times higher risk in people who exercised than those who did not exercise and a 1.78 times higher risk in people with a chronic disease than those without chronic diseases. Generally, people with a chronic disease showed a higher risk than those without chronic diseases. [Conclusion] The results of this study could be useful as basic data for improvement of police welfare, specialized treatment for the health safety of the police, and efficient management of police resources.

**Key words:** Police officers, Musculoskeletal disorders, Factors

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## INTRODUCTION

Police statistics indicate that there are 102,386 police officers in the Republic of Korea, that each police officer is responsible for 498 people, and that the police received 11,771,589 calls on their emergency number (112) for life safety in 2012<sup>1)</sup>, highlighting the increasing importance of the presence and role of the police. Under these circumstances, occupational disease-related accidents are reported in news media every day, and preventive health screening is actively encouraged. Nevertheless, there has been insufficient research on the diseases of police officers despite studies of the factors, such as cerebrovascular disease<sup>2)</sup>. Most of the studied diseases have been job-related stress and posttraumatic stress<sup>3–5)</sup>. Therefore, many aspects of the diseases of police officers need to be examined for efficient human resource management, with musculoskeletal disorders forming an essential part of such studies. Many studies related to the musculoskeletal disorders associated with the recent high incidence of musculoskeletal disorders and

their subsequent economic loss are being conducted. According to the domestic rule of the Occupational Safety & Health Standard, the definition of musculoskeletal disorders is damage to nerves/muscles in the neck, shoulder, waist, arm/leg, and surrounding body tissues caused by repetitive motion, inappropriate position, use of excessive force, physical contact with sharp surfaces, vibration, temperature, etc<sup>6)</sup>. According to the Industrial Accident Statistics<sup>7)</sup> of the Occupational Safety and Health Agency related to musculoskeletal disorders, among a total of 5,077 people under medical treatment for musculoskeletal disorders in 2011, manufacturing workers comprised an overwhelming percentage (44.2%). The existing studies have been for manufacturing workers<sup>8)</sup>, such those involved in automobile manufacturing, but recent studies have begun to focus on medical field workers in hospitals<sup>9, 10)</sup>.

Park et al.<sup>11)</sup>, Kim<sup>12)</sup>, Lee<sup>13)</sup>, and Heo<sup>14)</sup> reported that 77.2% of workers in a dockyard, 30% of radiological technologists in a medical imaging department, 59.3% of dental technicians, and 44.9% of golf caddies claimed pains in the musculoskeletal system, respectively. Recently, research was performed on recruits of the marine corps, rather than general and riot police, and the results showed that the accumulated rates of musculoskeletal damage for 6 weeks of training was 13.4% and that more than half the damage was reported in the pelvic limbs below the knees<sup>15)</sup>. Nevertheless, more research on hypertonic public employees, such as fire fighters or police officers, is needed. In the case of

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police officers, the research for musculoskeletal disorders conducted by Rhee et al.<sup>16)</sup> examined the incidence of musculoskeletal disorders, but basic research regarding police officers is lacking. The aim of this research was to provide basic data for efficient human resources management and future comparison studies through examinations of musculoskeletal disorders of police officers.

## SUBJECTS AND METHODS

This study selected randomly patients who visited the National Police Hospital from March 2013 to May 2013. After explaining the intention of the survey and how to respond, a structured questionnaire was given to 353 subjects from 400 potential subjects. All participants signed a written informed consent form approved by the Institutional Review Board at the National Police Hospital.

Data processing was performed using the SPSS software (Windows, Ver. 18.0, SPSS Inc., Chicago, IL, USA), and the detailed statistical methodology was as follows. First, value was determined to identify the internal consistency for reliability assessment survey tool. Second, descriptive statistics were conducted to analyze the general characteristics of the subjects. Third, were determined by frequency analysis of the general characteristics of the study subjects. Fourth, based on cross analysis was used to determine the factors affecting musculoskeletal police officers. Dependent variable was the presence of MSD symptoms which were divided six body parts including the shoulder, arm/elbow, hand/wrist/finger, whole and leg/foot.

## RESULTS

The internal consistency of the survey tool, an analysis of the reliability revealed a high interval matching degree of 0.92 with respect to the musculoskeletal disorders. The mean age of the study subjects was  $52.92 \pm 8.71$  years and 71.1% were more than 50 years of age. All subjects (100%) were male. Regarding marital status, 93.5% were married. In terms of education level, the largest proportion of subjects were university graduates or higher (36.3%), followed in order by college graduates and high school graduates or less.

Regarding the job characteristics of the study subjects, 57.8% were police lieutenants, 40.79% worked in the living safety department, 41.4% had been police officers for 21–30 years, 44.8% had worked for 10 years or less in the department, 58.1% were on normal duties, and 36.0% worked mainly in Seoul-Gyeonggi region. Among the current smokers, 56.5% smoked more than 6 cigarettes per day. And 66% had chronic diseases and injuries (Table 1). Frequency analysis of the symptoms of musculoskeletal disorder in each revealed 271 subjects (76.8%) with pain in more than one area. Among them, 44.2% had shoulder pain, 41.4% had waist pain, 31.2% had neck pain, 26.1% had foot/leg pain, 16.7% had hand/wrist/finger pain, and 14.7% had arm/elbow. An analysis of the specific symptoms 53.2%, 53.8%, 44.1%, and 34.8% pain in both sides of the shoulder, arm/elbow, right side of hand/wrist/finger, and side and both sides of the leg/foot, respectively (Table 2). Regard-

ing the frequency of pain period, pain for approximately 1–7 days in the neck (43.6%), shoulder (30.1%), arm/elbow (25%), hand/wrist/finger (30.5%), waist (39.7%), and leg/foot (30.4%). Regarding the frequency of pain, pain in the neck (63.6%), shoulder (53.2%), arm/elbow (57.7%), hand/wrist/finger (66.1%), waist (50.0%), leg/foot (54.3%) were most common (Table 3). An examination of the frequency musculoskeletal for 1 year revealed for six months the neck (29.1%), shoulder (27.6%), arm/elbow (34.6%), hand/wrist/finger (30.5%), waist (39.0%). An analysis of the occurrence of symptoms of musculoskeletal disorders over the last 1 week neck (54.5%), shoulder (57.1%), arm/elbow (80.8%), hand/wrist/finger (67.8%), waist (63.7%), foot/leg (72.8%) to be most common (Table 4). Prior to multiple logistic regression analysis, the musculoskeletal related factors identified by cross analysis in police officers were as follows: marital status, title, and the presence of chronic disease in the shoulder; exercise and the presence of chronic disease in the arm/elbow; presence of chronic disease in the hand/wrist/fingers; age and driving status in the waist; and working type and the presence of chronic diseases in the leg/foot. Table 5 lists the result of multiple regression analysis for each factor.

Regarding the musculoskeletal disorders, in the shoulder, of corporal or had a 4.87 times higher risk, with chronic diseases had a 1.78 times higher risk than those without. In the arm/elbow, who exercised had a 2.37 times higher risk than those who did not, with chronic had a 1.78 times higher risk than those who without. In the hand/wrist/fingers, with chronic diseases had a 2.57 times higher risk than those without. In the waist, years old had a risk 0.35 times that of those 40 years old or less, people who drive had a 0.39 times those who did not. In the leg/foot, shift work had a 1.66 times higher risk than those, and with chronic diseases had a 2.24 times higher risk than those without. Overall, people with chronic diseases had a 1.74 times higher risk of pain than those without chronic diseases ( $p > 0.05$ ).

## DISCUSSION

Occupations affecting musculoskeletal disorders in the manufacturing industry have been evaluated for a long time. According to Kim et al.<sup>17)</sup>, non-manufacturing showed similar types of musculoskeletal disorder hazard factors to those found in manufacturing industries. Currently, the department, agricultural workers, and health personnel have been studied widely. Nevertheless, research on hypertonic public officers is lacking. In particular, regarding fire fighters, Kang<sup>18)</sup> examined musculoskeletal fire fighting work but there is a paucity of research on police officers. In the case of police officers, job types are classified according to the progress and specialty code, where exposure to hot or cold cannot be avoided during public official duties. In addition, training for fighting crimes and the use of excessive force are involve continuously in actual situations. In addition, in the case of office workers, the possibility of stress and musculoskeletal disorder increasing with the development of society environment, such as working posture due to prolonged computer use etc., working environment and

**Table 1.** General characteristics (n = 353)

Variables	Characteristics	Classification	Frequency (%)
General characteristics	Age	≤ 40	31 (8.8)
		41–50	71 (20.1)
		≥ 51	251 (71.1)
	Gender	Male	353 (100)
		Female	0 (0)
	Marital status	Single	23 (6.5)
		Married	330 (93.5)
	Education level	High school	105 (29.7)
		College	120 (34.0)
		More University	128 (36.3)
Class	≤ Senior Policeman	23 (6.5)	
	Assistant Inspector	50 (14.2)	
	Inspector	204 (57.8)	
	Senior Inspector	56 (15.9)	
	≥ Superintendent	20 (5.6)	
	Job types	Police affairs	111 (31.4)
Work characteristics	Period of worked (yr)	Life security	144 (40.8)
		Traffic police	13 (3.7)
		Guard police	36 (10.2)
		Investigate – Detective	31 (8.8)
		Intelligence – Peace preservation police	14 (4.0)
	Maritime police etc.	4 (1.1)	
	Period of department worked (yr)	≤ 10	27 (7.6)
		11–20	37 (10.5)
		21–30	146 (41.4)
		≥ 31	143 (40.5)
Work type	≤ 10	158 (44.8)	
	11–20	38 (10.8)	
	21–30	87 (24.6)	
	≥ 31	70 (19.8)	
Work	Fix	205 (58.1)	
	Shift	148 (41.9)	
	Seoul and Gyeonggi-do	127 (36.0)	
	Gangwon-do	28 (7.9)	
	Chungcheong-do	67 (19.0)	
	Gyeongsang-do	79 (22.4)	
Life characteristics	Smoking	Jeolla-do and Jeju-do	52 (14.7)
		Non-smoker	284 (80.5)
	Cigarettes/day	Smoker	69 (19.5)
		≤ 5	30 (43.5)
	Alcohol drinking	≥ 6	39 (56.5)
		No	55 (15.6)
	Drive	Yes	298 (84.4)
		No	24 (6.8)
	Exercise	Yes	329 (93.2)
		No	86 (24.4)
Chronic	Yes	267 (75.6)	
	No	120 (34.0)	
	Yes	233 (66.0)	

strength, conflict and protection with the complaint raiser, and exposure to the risks of musculoskeletal clearly. Accordingly, the musculoskeletal disorders of police officers were analyzed and the occurrence characteristics were determined.

The pain frequency as a musculoskeletal disorder symptom according to the body part were the shoulder, waist, neck, leg/foot, hand/wrist/fingers, and arm/elbow. The frequency was 44.3% in the shoulder, 41.4% in the waist, 31.2% in the neck, 26.1% in the leg/foot, 16.7% in the hand/wrist/fingers, and 14.7% in the arm/elbow respectively. Other occupations, Choi et al.<sup>8)</sup> evaluated automobile manufacturing workers who complained of pain and reported the shoulder (56.7%), hand/wrist/finger (36.7%), waist (36.1%), arm and leg (32.2% each), neck (17.2%) to be the most common sites. Park et al.<sup>10)</sup> assessed hospital workers and reported the following prevalence: shoulder (48.7%), waist (34.6%), leg/foot (32.7%), neck (27.9%), wrist/hand/finger (26.7%), and elbow (12.0%). In addition, Kim et al.<sup>19)</sup> examined occupational status and characteristics and revealed musculoskeletal disorders in the waist (35.7%), neck (19.0%), shoulder (18.4%), wrist/hand (11.0%), arm/elbow (8.1%), and leg/foot (7.3%). The reason for the difference in the pain part in the study subjects could be difference in the body used, the severity of muscle use, and working environment<sup>20, 21)</sup>. Among the studies related to police officers, according to Cho et al.<sup>22)</sup>, the test frequency of radiology was 46.90% in the lower extremities, 27.03% in the upper extremities, and 26.05% in the spine. In the lower extremities, the knee (52.3%), ankle (52.3%), and foot (11.07%) were the most common sites. In the upper extremities, the shoulder (39.35%), wrist (15.64%), hand (14.05%), and elbow (10.30%) were the most common sites. The waist (55.68%) and neck (40.41%) were overwhelmingly the most common sites in the spinal area. The most frequent parts of the test were the knee, shoulder and neck. In study, the knee was not and was combined with the leg, so it could not be matched but the pain frequency were the shoulder, waist, and neck in that order.

In characterizing the pain of police officers, reported that persisted for 1–7 days at least once in the last 6 months, and more than 50% experienced pain during the past week. Overall, many police officers have chronic mild pain, but considering the mean age study subjects (older than 50 years of age), the confounding factor of age should be considered.

Multiple regression analysis the shoulder revealed police lieutenants to have the highest 4.87 times that of corporals or because the cause of the disease was repetitive motion, and lieutenants are generally senior workers and would cause this result in addition to age<sup>23)</sup>.

In the arm/elbow, the risk of musculoskeletal disorders was 2.37 times higher in who exercised than in those who did not. Park et al.<sup>24)</sup> reported that musculoskeletal disorders in the arm/elbow manifested mainly as pain around the elbow, weakness, restriction of movement, etc. In the case of regular exercise, muscle development and power changed according to the type and strength, and the prevalence of musculoskeletal disorders was lower than in those who did not exercise. On the other hand, many hobby activities could worsen the symptoms due to the nature of the hobby.

**Table 2.** Frequency and location of musculoskeletal disorders

Part	Classification	Frequency (%)
Whole	No	82 (23.2)
	Yes	271 (76.8)
Neck	No	243 (68.8)
	Yes	110 (31.2)
Shoulder	No	197 (55.8)
	Yes	156 (44.2)
Arm/Elbow	No	301 (85.3)
	Yes	52 (14.7)
Hand/Wrist/Finger	No	294 (83.3)
	Yes	59 (16.7)
Lumbar	No	207 (58.6)
	Yes	146 (41.4)
Leg/Foot	No	261 (73.9)
	Yes	92 (26.1)

  

Part	Frequency (%)		
	Right	Left	Both
Shoulder	50 (32.1)	23 (14.7)	83 (53.2)
Arm/Elbow	28 (53.8)	12 (23.1)	12 (23.1)
Hand/Wrist/Finger	26 (44.1)	13 (22.0)	20 (33.9)
Leg/Foot	28 (30.4)	32 (34.8)	32 (34.8)

**Table 3.** Period frequency and pain extent frequency of musculoskeletal disorders

Part	Frequency (%)				
	< 1 d	1–7 d	7 d–1 m	1–6 m	≥ 6 m
Neck	33 (30.0)	48 (43.6)	15 (13.6)	3 (2.7)	11 (10.0)
Shoulder	45 (28.8)	47 (30.1)	24 (15.4)	16 (10.3)	24 (15.4)
Arm/Elbow	11 (21.2)	13 (25.0)	10 (19.2)	10 (19.2)	8 (15.4)
Hand/Wrist/Finger	13 (22.0)	18 (30.5)	6 (10.2)	11(18.6)	11 (18.6)
Lumbar	30 (20.5)	58 (39.7)	25 (17.1)	8 (5.5)	25 (17.1)
Leg/Foot	20 (21.7)	28 (30.4)	10 (10.9)	10 (10.9)	24 (26.1)

  

Part	Frequency (%)			
	Mild	Moderate	Severe	Extremely severe
Neck	70 (63.6)	34 (30.9)	6 (5.5)	0
Shoulder	83 (53.2)	47 (30.1)	23 (14.7)	3 (1.9)
Arm/Elbow	30 (57.7)	12 (23.1)	9 (17.3)	1 (1.9)
Hand/Wrist/Finger	39 (66.1)	15 (25.4)	5 (8.5)	0
Lumbar	73 (50.0)	57 (39.0)	13 (8.9)	3 (2.1)
Leg/Foot	50 (54.3)	28 (30.4)	12 (13.0)	2 (2.2)

Considering these studies and the job characteristics of police officers, the police officer's exercise requires continuous research regarding training.

Years of age had a 0.35 times that of those under 40 years of age, and who drove had a 0.39 times those who did not. Shin et al.<sup>25)</sup> reported that for the occupational driver, although there was no statistical difference, the highest frequency of pain was observed in those 34 to 45 years of age, which is similar to the present data. In this study, police officers under the 40 years of age showed a high incidence of musculoskeletal disorders those 41 years or older, and attributed to the relative activity. In addition, in previous

studies, between vibrations caused by driving and backache<sup>26, 27)</sup> and fixed posture etc. were seen as extended concepts of an uncomfortable position<sup>24)</sup>. All studies of driver's backache 30 years<sup>27)</sup> in to account, it can be concluded that driving backache significantly, and the risk ratio of backache 2.2 to 4.6 times higher than who do not drive<sup>26)</sup>. Previous studies examined occupational drivers, but this study focused on police, nevertheless, a relatively older mean age might be a confounding factor.

In leg/foot musculoskeletal disorders, shift workers had a 1.66 times higher risk than those who do not. Although the level of significance was not 0.05 the type, there was a re-

**Table 4.** Symptom frequency of Musculoskeletal disorders of 1 year and last week

Part	Frequency (%)				
	1/6 m	1/2–3 m	1/1 m	1/1 w	Daily
Neck	32 (29.1)	29 (26.4)	20 (18.2)	12 (10.9)	17 (15.5)
Shoulder	43 (27.6)	36 (23.1)	14 (9.0)	29 (18.6)	34 (21.8)
Arm/Elbow	18 (34.6)	8 (15.4)	6 (11.5)	7 (13.5)	13 (25.0)
Hand/Wrist/Finger	18 (30.5)	8 (13.6)	8 (13.6)	13 (22.0)	12 (20.3)
Lumbar	57 (39.0)	29 (19.9)	22 (15.1)	14 (9.6)	24 (16.4)
Leg/Foot	24 (26.1)	14 (15.2)	14 (15.2)	21 (22.8)	19 (20.7)
Part	Classification		Frequency (%)		
Neck	No		50 (45.5)		
	Yes		60 (54.5)		
Shoulder	No		67 (42.9)		
	Yes		89 (57.1)		
Arm/Elbow	No		10 (19.2)		
	Yes		42 (80.8)		
Hand/Wrist/Finger	No		19 (32.2)		
	Yes		40 (67.8)		
Lumbar	No		53 (36.3)		
	Yes		93 (63.7)		
Leg/Foot	No		25 (27.2)		
	Yes		67 (72.8)		

**Table 5.** Multiple logistic regression analysis for predicting musculoskeletal disorder

Part	Variables	B	F	p-value	OR	CI (95%)	
						Lower	Upper
Shoulder	≤ Senior Policeman		4	0.007*			
	Assistant Inspector	1.507	1	0.016*	4.51	1.332	15.281
	Inspector	1.584	1	0.006*	4.87	1.592	14.921
	Senior Inspector	1.103	1	0.074	3.01	0.898	10.108
	≥ Superintendent	0.148	1	0.851	1.16	0.247	5.432
	Chronic	0.574	1	0.015*	1.78	1.116	2.823
Arm/Elbow	Exercise	0.865	1	0.046*	2.37	1.015	5.551
	Chronic	1.777	1	0.000*	5.91	2.279	15.341
Hand/Wrist/Finger	Chronic	0.944	1	0.008*	2.57	1.281	5.160
Lumbar	Age		2	0.063			
	≤ 40						
	41–50	-1.043	1	0.025*	0.35	0.141	0.877
	≥ 51	-0.551	1	0.181	0.58	0.257	1.291
	Drive	-0.936	1	0.047*	0.39	0.156	0.986
Leg/Foot	Work type	0.504	1	0.041*	1.66	1.020	2.688
	Chronic	0.805	1	0.005*	2.24	1.281	3.907
Whole	Chronic	0.555	1	0.032*	1.74	1.050	2.891

relationship with shoulder, hand/wrist/finger to a significance of 0.1. Therefore, the possible relationship between shift work and musculoskeletal disorders will require further analysis. Previous studies revealed a relationship between shift work and stress<sup>28–30</sup>. In research the relationship between the musculoskeletal disorders and stress, one theory<sup>31</sup> stated that muscle tension developed, and progressed to musculoskeletal disorders or stress delays the recovery of inflammation status due to the physical job condition or decreases the pain threshold in the muscle due to stress.

Choi et al. examined the relationship between musculoskeletal disorders and job stress<sup>8</sup>). The present study assumed a similar relationship. In addition, considering the job characteristics, a job with shifts should be considered to be the accumulation of outdoor activities including patrolling, criminal arrest, etc..

This study had some limitations. First, there were no females due to the occupational characteristics of police officers so a gender comparison could not be made. Second, there were many 50 years and older, which could be

considered a confounding variable. This might be affected by the population recruited at the specific place of the hospital. Third, this study involved a questionnaire without a doctor's interview or radiological test regarding the musculoskeletal disorder, so there is a possibility of subjectivity. Nevertheless, the results have meaning in that this research examined the police officer's work and recruited an even population randomly from various parts nationwide. Future studies of simple musculoskeletal disorders and the relationship with duty stress might assist in the management of police officers. In terms of efficient human resources management, the shoulder, waist, neck, leg/foot, hand/wrist/finger, and arm/elbow should be recognized as multi frequent pain parts and there is a necessity to develop programs to prevent accidents or injuries. In addition, total management for other diseases will be needed by paying full attention to the management of police officer's chronic diseases as well as the injury-related factors in each part. Overall, this study provides basic data for efficient police officer manpower and future related research.

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