Health Status of Veterans with Spinal Cord Injury during Screening Program in Tehran 2013: Investigating the Pulmonary Function - a Preliminary Report

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Abstract

Respiratory problems are a major cause of death in people with spinal cord injury. More than 2000 veterans with spinal cord injury live in Iran. This study aimed to evaluate the pulmonary function of veterans with spinal cord injury participating in the health-screening program in Tehran-2013. This retrospective descriptive study was conducted by reviewing participants' medical records. All veterans (368) were male with the mean age of 49.62 ± 6.45 years. The mean time since injury was 27.17 ± 5.03 years; 32 veterans (8.7%) suffered from tetraplegia and 336 (91.3%) were paraplegic; 120 veterans (32.6%) had complete spinal cord injury and 248 had incomplete spinal cord injury (67.4%). Among them, 159 veterans had difficulty coughing; 198 complained of dyspnea and 119 had a history of hospitalization for pneumonia during the last year. According to results, it seems that veterans' pulmonary status in the screening was appropriate indicating the suitability of periodic visits to veterans in the home care program. It is suggested that future studies be conducted simultaneously with health screening programs and the international standard forms be used in patients' medical records.

Keywords: Veterans, Spinal cord injury, Respiratory status

Introduction

About 2200 veterans with spinal cord injury live in Iran whose injuries are due to Iraq-Iran war and fight against drugs (Rahimi-Movaghar, et al., 2010). Life expectancy in people with spinal cord injury one year after injury is about 90 percent of normal people (Burns, et al., 2014). Spinal cord injury that lasts more than a year is called chronic spinal cord injury that can cause different physical and psychological disorders in long term, one of which is respiratory system problems (Galeiras, et al., 2013). Respiratory problems are a major cause of death in people with spinal cord injury (Tollefsen and Fondenes, 2012). Ineffective cough, weakness of respiratory muscles, respiratory infections, pulmonary embolism and pulmonary failure are the major respiratory problems in these people (Zimmer, et al., 2007). To enhance the quality of life and minimize injured veterans' physical and mental problems, regular screening and evaluation of their health are needed. Injured veterans' health screening program is extensively conducted regionally by Janbazan spinal cord injuries centers across the country. In this program, injured veterans are visited periodically at home and are examined in specialty health centers once a year. This study aimed to evaluate the pulmonary function of veterans with spinal cord injury participating in the health-screening program in Tehran-2013.

Methods

This cross-sectional retrospective descriptive study was conducted by reviewing injured veterans' medical records participating in the health screening program in Khatam Alanbia Hospital, Tehran, in 2013, supervised by Shefa Neuroscience Research Center. Inclusion criteria were at least one year elapsed since the injury, level of injury lower than C3, having no history of hospitalization and using mechanical ventilation in 3 months prior to attending the center. Data were collected in a checklist of demographic information, spirometry results and history of pneumonia, cough, dyspnea, the type and level of injury. The type of injury was determined based on complete or incomplete injury and the level of injury based on the Cervical, thoracic and lumbar spinal cord injury and also based on tetraplegia and paraplegia. Unfortunately, Type of injury was not written according to ASIA classification in veterans' medical records and only FEV1 and FVC and the ratio could be extracted from spirometry results.

Data were analyzed in SPSS v20 software and the significance level was considered less than 0.05 ($p<0.05$).

Results And Discussion

Among participants, 368 injured veterans had the inclusion criteria for the study. All subjects were male with the mean age of 49.62 ± 6.45 years. The mean time since injury was 27.17 ± 5.03 years; 32 veterans (8.7%) suffered from tetraplegia and 336 (91.3%) were paraplegic; 120 veterans (32.6%) had complete and 248 had incomplete spinal cord injury (67.4%).

Among them, 159 veterans had problem for effective coughing; 198 complained of dyspnea and 119 had a history of hospitalization for pneumonia during the last year.

Tables 1, 2 and 3 show the results based on 3 models. Table 1 presents data based on complete and incomplete spinal cord injury. In this model, there was a significant statistical difference between the two groups in terms of FEV1 and FVC and FEV/FVC and they were higher in incomplete spinal cord injury.

Table 1. Characteristics of veterans based on Injury type.

Characteristics		Injury		p value
		Complete (N= 120)	Incomplete (N=248)	
Tetraplegia, N %		16 (13.3)	16 (6.45)	0.05>
Paraplegia, N %		104 (86.6)	232 (93.54)	
Level of injury, N %	Cervical	16 (13.3)	16 (6.45)	0.001>
	Thoracic	54 (45)	186 (75)	
	Lumbar	50 (41.6)	46 (18.54)	
Age, mean±SD, y		49.40±6.98	49.73±6.2	
Post SCI period, mean±SD, y		27.36±4.96	27.09±5.07	
FEV1, mean±SD, L		2.76±0.75	3.08±0.48	0.001>
FVC, mean±SD, L		3.09±0.79	3.42±0.50	0.001>
FEV1/FVC, mean±SD, %		88.66±5.04	90.18±3.14	0.01>
Ineffective Cough, N %		55 (45.8)	104 (41.93)	
Dyspnea, N %		62 (51.6)	136 (54.83)	
Hx of Pneumonia, N %		35 (29.1)	84 (33.87)	
Smoker, N %		8 (6.6)	65 (26.20)	0.001>
BMI, N %	<25	43 (35.83)	76 (30.64)	
	25-30	55 (45.83)	129 (52.01)	
	≥30	22 (18.33)	43 (17.33)	

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Table 2. Characteristics of veterans based on type of plegia.

Characteristics		Tetraplegia (N=32)	Paraplegia (N=336)	p value
Age, mean±SD, y		49.40±7.03	49.64±6.41	
Post SCI period, mean±SD, y		27.37±4.85	27.15±5.05	
FEV1, mean±SD, L		2.28±0.80	3.04±0.54	0.01>
FVC, mean±SD, L		2.57±0.83	3.38±0.56	0.001>
FEV1/FVC, mean±SD, %		88.13±5.56	89.82±3.71	
Ineffective Cough, N %		16 (50)	143 (42.55)	
Dyspnea, N %		16 (50)	182 (54.16)	
Hx of Pneumonia, N %		14 (43.75)	105 (31.25)	
Smoker, N %		0 (0)	73 (21.72)	
BMI, N %	<25	12 (37.5)	107 (31.84)	
	25-30	13 (40.62)	171 (50.89)	
	≥30	7 (21.87)	58 (17.26)	

Table 3. Characteristics of veterans based on level of injury.

Characteristics		Level of injury			p value
		Cervical (N=32)	Thoracic (N=240)	Lumbar (N=96)	
Age, mean±SD, y		49.40±7.03	49.64±6.41	48.92±7.33	
Post SCI period, mean±SD, y		27.37±4.85	27.15±5.05	26.90±5.68	
FEV1, mean±SD, L		2.28±0.80	3.04±0.54	3.32±0.42	0.001>
FVC, mean±SD, L		2.57±0.83	3.38±0.56	3.65±0.43	0.001>
FEV1/FVC, mean±SD, %		88.13±5.56	89.82±3.71	90.86±3.34	0.001>
Cough, N %		16 (50)	101 (42.08)	42 (43.75)	
Dyspnea, N %		16 (50)	131 (54.16)	51 (53.12)	
Pneumonia, N %		14 (43.75)	74 (54.58)	31 (32.29)	
Smoker, N %		0 (0)	54 (22.5)	19 (19.79)	0.01>
BMI, N %	<25	12 (37.5)	77 (32.08)	30 (31.25)	
	25-30	13 (40.62)	120 (50)	51 (53.12)	
	≥30	7 (21.87)	43 (17.91)	15 (15.62)	

Based on the data shown in Tables 2 and 3, FEV1 and FVC were significantly higher in paraplegic, thoracic and lumbar group. Reviewing the effect of age and the time period after injury, BMI and smoking on FEV1 and FVC and FEV/FVC, no significant relationship was observed. In this study, the results of spirometry indices are the same as cohort studies in which people are not able to perform spirometry according to ATS standards. In these people, the rate of FEV1 decline is observed more, and mortality is also increased (Stolzmann, et al., 2008). Although a history of respiratory symptoms such as ineffective cough, dyspnea and respiratory infection in people without spinal cord injury can affect the results of spirometry (Petsonk and Wang, 2010), this condition was not significantly seen in people with spinal cord injury and the reason for this difference is not well understood (Galeiras, et al., 2013). In this study, FEV1/FVC was reduced in complete spinal cord injury and high level injury. In Los Angeles cohort study

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(Jain, et al., 2006), there was a higher proportion of tetraplegia than paraplegia which is the opposite of our result. Several studies on non-spinal cord injury showed that the ratio of FEV1/FVC increases with increasing BMI (Galeiras, et al., 2013). In our study, there was no significant relationship between BMI and spirometry indices, while a study on patients with spinal cord injury showed that FEV1/FVC is decreased by increasing weight and BMI (Stepp, et al., 2008).

In spinal cord injury, pulmonary volumes and air flow rate are decreased due to respiratory muscle weakness (Tollefsen and Fondenes, 2012). Changes in spirometry results can be affected by the level of injury, lying or sitting position during the test (Terson, et al., 2014). Several studies show pulmonary volumes especially FVC and FEV1 increase in lower level spinal cord injury; while higher level of injury reduces the total lung volume (Stolzmann, et al., 2008; Kelley, et al., 2013). With increased residual volume, functional residual capacity volume is decreased. Decreased expiratory reserve volume can have a direct relationship with the main and abdominal respiratory muscle weakness (Jain, et al., 2006). A recent study showed that pulmonary volumes and oxygenation are improved in a semi-sitting position in the acute respiratory distress syndrome. However, the studies on individuals with spinal cord injury suggest that tetraplegic people show better pulmonary function in the supine position (Terson, et al., 2014). With increasing age and decreasing weight, FVC and FEV1 increases in normal people. However, these effects may be indirect. Respiratory system dysfunction depends on the extent and the level of injury and nerve damage, so that patients with cervical spinal cord injury and upper thoracic injury are at a greater risk of respiratory disorders (Petsonk and Wang, 2010; Galeiras, et al., 2013). Several studies also indicate that the dependence on mechanical ventilation is higher in patients with cervical spinal cord injury higher than C4 (Zimmer, et al., 2007; Tollefsen and Fondenes, 2012). In our study, an inverse relationship was observed between the time period after injury and FVC and FEV1, and FVC and FEV1 was better as time passed. However, most studies have reported a decrease in FVC and FEV1 (Jain, et al., 2006; Kelley, et al., 2013). This difference could be due to the number of tetraplegic people and injury with complete neurological damage in studies. In this study, this situation can be indirectly justified by the better nursing and care of injured veterans. Many factors affect spirometry results of people with spinal cord injury, however, this study showed that the reduction in FEV1 and FVC in veterans with spinal cord injury is directly associated with the type (complete and incomplete) and the level of injury.

In general, according to results, it seems that veterans' respiratory status in the screening was appropriate indicating proper regular visits of veterans at home. It is suggested that future studies be conducted simultaneously with health screening programs and the international standard forms be used in patients' medical records.

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