척수손상환자의 폐활량에 자세가 미치는 영향

The Effect of Position on Measured Lung Capacity of Patients with Spinal Cord Injury

김 명 권, 황보 각*
영산대학교, 대구대학교*

Myoung-Kwon Kim, Gak Hwangbo*
Young San Univ., Daegu Univ.*

Abstract

To determine whether position affects measured lung capacity of spinal cord injury patients. The study subjects were 45 patients with spinal cord injury (cervical level 15, thoracic level 15, lumbar level 15). Subjects were provided with a full explanation of the experimental procedures and all provided written consent signifying their voluntary participation. We used a spirometer (Spirometer, Micromedical Ltd, UK) to measure pulmonary function in the supine and sitting positions (straightened upper body at an angle of 90°). Forced vital capacity (FVC), forced expiratory volume during the first second (FEV1), tidal volume (TV), and maximum insufflation capacity (MIC) were also measured. FVC, FEV1, TV, MIC (%) were greater in the supine than in the sitting position for those with injury at the cervical or thoracic injury level. On the other hand, FVC, FEV1, TV, MIC (%) were lower in the supine position for those with an injury at the lumbar level. More attention should be paid to the effect of injury level on measured lung capacity.

Ⅰ. Introduction

Mortalities caused by respiratory complications in patients with neuromuscular diseases, especially patients with spinal cord injuries, have reduced, because of recent developments in respiratory care and treatment modalities 1). However, although mortality caused by respiratory complications has reduced, time after injury and degree of respiratory muscle weakness are key prognostic factors for patients with spinal cord injury. Therefore, the understanding and assessment of respiratory functional impairment is of the utmost importance during treatment decision making 2). Lechtzin and Wiener 3) reported that measurements of lung capacity in amyotrophic lateral sclerosis patients in the supine position are a more sensitive indicator of diaphragm function than measurements taken in the sitting position, and Varrato et al. 4) showed differences in lung capacity rates measured in the sitting and supine positions provide more sensitive indicator of diaphragm function.

Relatively few studies have examined the effect of position on pulmonary measurements of spinal cord injury patients. In the present study, we studied whether position affects measured lung capacity of spinal cord injury patients.

Ⅱ. Subject and Methods

The subjects of this study were 45 patients with spinal cord injury (Table 1). We measured of pulmonary function in the supine and sitting positions (straight upper body at an angle of 90°) using a Bobath table (AKRON Mat Table, AKRON, UK) which is foldable. Measurements were made in triplicate and the maximum values were used in the analysis. Pulmonary function was measured using a spirometer (Spirometer, Micromedical Ltd, UK). Forced vital capacity (FVC), forced expiratory volume during the first second (FEV1), tidal volume (TV), and maximum insufflation capacity (MIC) were measured.

Data were analyzed using one-way ANOVA and SPSS Ver. 12.0 for Windows. We used Tukey's measure as a post hoc test. Statistical significance was accepted for p values of 〈0.05.

Ⅲ. Results

For patients with cervical level injury, mean FVC(%) was 5.13±3.10% higher in the supine position than in the sitting position. For patients with thoracic level injury, mean FVC(%) was

4.20±3.23% higher in the supine position, and for patients with lumbar level injury, FVC(%) was -1.93±1.62% lower in the supine position. Post hoc testing revealed significant differences between the mean FVC(%) values of patients with cervical and lumbar injuries and those with thoracic and lumbar injuries.

For patients with injury at the cervical level, mean FEV1(%) was 5.70±2.44 % higher in the supine position than in the sitting position, for patients with a thoracic level injury, mean FEV1(%) was 4.39±2.39 % higher in the supine position, and for those with lumbar level injury, mean FEV1(%) was −1.30±1.20% lower in the supine position.

Post hoc testing revealed significant differences between the mean FEV1(%) values of patients with cervical and lumbar injuries and those with thoracic and lumbar injuries.

For patients with cervical level injury, TV(%) was 2.85±1.47 % higher in the supine position than in the sitting position, for those with thoracic level injury, mean TV(%) was 3.61±1.90 % higher in the supine position, and for those with lumber level injury, mean TV(%) was −1.64±1.24% lower in the supine position.

Post hoc testing revealed a significant differences between the mean TV(%) values of patients with cervical and lumbar injuries and those with thoracic and lumbar injuries.

For patients with cervical level injury, mean MIC(%) was 4.73±2.00% higher in the supine position, for patients with thoracic level injury, mean MIC(%) was 3.57±1.62% higher in the supine position, and for patients with lumber level injury, mean MIC(%) was −0.28±054% lower in the supine position.

Post−hoc testing revealed a significant differences between the mean MIC(%) values of patients with cervical and lumbar injuries and a thoracic and lumbar injuries.

Ⅳ. Discussion

Our results indicate significant differences related to measurement position in the FVC, FEV1, TV, and MIC values of spinal cord injury patients regardless of the location of injury. Specifically, for patients with an injury at the lumbar level, FVC, FEV1, TV, and MIC were all higher in the supine position than in the sitting position, but without statistical significance. The up−and−down motion of the diaphragm is influenced by changes in position, degree of stomach expansion, and abdominal obesity. The reason why there is a difference between the measured lung capacities of spinal cord injury patients in different patient positions is that when patients with a thoracic level injury exhale lung capacity measured in the sitting position is less than in the supine position, because the dilated lung and thorax shrink passively by recoil, and because the effect of gravity on abdominal contents reduces diaphragm excursion.

Reference

[1] Aboussouan LS, Khan SU, Banerjee M et al, “Objective measures of the efficacy of noninvasive positive pressure ventilation in amyotrophic lateral sclerosis.” Muscle Nerve, 2001, Vol. 24, pp403−409.

[2] De vivo MJ, Krause JS, Lammertse DP, “Recent trends in mortality and causes of death among persons with spinal cord injury.” Arch Phys Med Rehabil, 1999, Vol. 80, pp1411−1419.

[3] Lechtzin N, Wiener CM, Shade DM et al, “Spirometry in the supine position improves the detection of diaphragmatic weakness in patients with amyotrophic lateral sclerosis.” Chest, 2002, Vol. 121, pp 436−442.

[4] Varrato J, Siderowf A, Damiano P et al “Postural change of forced vital capacity predicts some respiratory symptoms in ALS.” Neurology, 2001, Vol. 57, pp 357−359.