

Occupational therapy for patients with spinal cord injury in early rehabilitation

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Key words: spinal cord injury, rehabilitation, independence, occupational therapy.

Summary. *Objective.* To determine factors influencing the effectiveness of occupational therapy of patients with spinal cord injury in early rehabilitation.

Material and methods. Data were obtained on 136 patients with spinal cord injury admitted to the Department of Rehabilitation, Kaunas University of Medicine Hospital in 1999–2005. The study population consisted of 97 (71.3%) males and 39 (28.7%) females. Complex rehabilitation was started after the stabilization of functional state in the Department of Neurosurgery and transfer to Department of Rehabilitation. The average duration of early rehabilitation in the Department of Rehabilitation was 68.3 ± 22.5 days. According to the level of spinal cord injury patients were divided into two groups: patients with cervical lesions (C1-Th1 segments) and with thoracic-lumbar lesions (Th2-S1 segments). According to the level of spinal cord injury patients also were divided into two groups: complete (American Spinal Injury Association (ASIA-A)) and incomplete injury (ASIA-B, ASIA-C). The evaluation of the level of patients' independence was dependent on the level of injury: C4; C5; C6; C7-C8; Th1-Th9; Th10-L1; L2-S5 segments. Functional state and activity were evaluated by Functional Independence Measure (FIM). Effectiveness of occupational therapy was supposed to be good, if predicted independence level of final rehabilitation was achieved by a patient and it was supposed to be unsatisfactory if the same level of independence was not achieved.

Results. The examination of patients has shown that 21 (15.4%) patients had complete injury (ASIA-A) in cervical level and 41 (30.2%) patients had complete injury in thoracic-lumbar level. Thirty-five (25.7%) patients had incomplete injury in cervical area and 39 (28.7%) patients in thoracic-lumbar level. At the end of early rehabilitation period in the case of complete spinal cord injury in cervical level (C4-C8) the expected level was achieved by 33.3–100% of patients. In the case of incomplete injury the expected level was achieved by 87.5–100% of patients. No patient with spinal cord injury in thoracic-lumbar (Th1-S5) level achieved the expected level of independence of final rehabilitation in early rehabilitation period.

Conclusions. Patients with spinal cord injury had disturbances of all activities according to FIM in early rehabilitation. The level of spinal cord injury had greater influence on the level of independence of patients with injury in cervical level rather than in thoracic-lumbar level. The level of independence in early rehabilitation period was achieved in 17.7% of complete spinal cord injury cases and in 45.9% of incomplete spinal cord injury cases.

Introduction

Spinal cord injury is a topical contemporary problem in community and medicine areas (1). The incidence of spinal cord injury is 15 to 40 cases per million population in the developed countries annually; in Lithuania – about 140 individuals annually (2). More than 60% of all cases of spinal cord injury occur in persons younger than 30 years (3).

Occupational therapy as a part of complex rehabilitation is applied in solving the problems of occupa-

tion (self-care, work and leisure) of patients. According to S. Guidetti and K. Tham the training of self-care is one of the most important goals of occupational therapy (4). General aims of occupational therapy comprise the adaptation of social, living and other kinds of environment for the disabled, whereas individual aims are specific and related to a certain patient, the realization of which is easier to control (5). It is emphasized that early occupational therapy started immediately after the stabilization of patient's func-

nal state is of great importance (6). M. C. Schonherr, J. W. Groothoff and others state that significant progress in independence was made in self-care, mobility and bladder and bowel care during rehabilitation. The achievement of expected outcome of these patients during rehabilitation is comparatively unknown. In 52% of all performed skills, independence was achieved at discharge. Prediction of self-care outcome of patients with tetraplegia is far more complicated (7).

The aim of this study was to determine factors influencing the effectiveness of occupational therapy of patients with spinal cord injury in early rehabilitation. The goals were: to evaluate the functional state and dominating dysfunctions of patients with spinal cord injury in early rehabilitation; to assess the effectiveness of occupational therapy dependent on the level and completeness of spinal cord injury.

Material and methods

Data were obtained on 136 patients with spinal cord injury admitted to the Department of Rehabilitation, Kaunas University of Medicine Hospital in 1999–2005. The study population consisted of 97 (71.3%) males and 39 (28.7%) females. Complex rehabilitation was started after the stabilization of patients' functional state in the Department of Neurosurgery and transferring patients to the Department of Rehabilitation. The average duration of early rehabilitation in the Department of Rehabilitation was 68.3 ± 22.5 days. According to the level of spinal cord injury patients were divided into two groups: patients with cervical lesions (C1-Th1 segments) and with thoracic-lumbar lesions (Th2-S1 segments). According to completeness of spinal cord injury patients also were divided into two groups: complete (ASIA-A) and incomplete injury (ASIA-B, ASIA-C). The evaluation of the level of independence of patients was dependent on the level of injury: C4; C5; C6; C7-C8; Th1-Th9; Th10-L1; L2-S5 segments. Functional state and activity were evaluated by the Functional Independence Measure (FIM). Effectiveness of occupational therapy was supposed to be good, when a patient achieved predicted independence level of final rehabilitation and if the same level of independence was not achieved it was supposed to be unsatisfactory (6).

The following activities were evaluated: eating, grooming, dressing upper and lower part of the body, toileting, bathing, bowel and bladders control, transfers in bed, from wheelchair, in toilet, shower/bathroom, walking or/and using wheelchair, stairs. During rehabilitation occupational therapy procedures were applied according to the protocol ratified by the De-

partment of Rehabilitation. Statistical analysis of data was performed using Man-Whitney-Wilcoxon sum of ranks analysis with $p < 0.05$ as the minimal level of significance. The data were analyzed by statistical program "STATISTICA".

Results

The examination of patients has shown that 21 (15.4%) patients had complete injury (ASIA-A) in cervical level and 41 (30.2%) patients had complete injury in thoracic-lumbar level. Thirty-five (25.7%) patients had incomplete injury in cervical area and 39 (28.7%) patients in thoracic-lumbar level.

The evaluation of activity improvement of patients by FIM in early rehabilitation has shown that in the case of complete spinal cord injury (ASIA-A) in cervical level the greatest improvement was noticed in using wheelchair and eating, 3.81 ± 1.6 and 2.43 ± 1.5 points respectively. The level of independence maintained unchanged in transferring in a toilet, bathroom – 0, and a slight change of independence has been noticed in bathing – 0.14 ± 0.48 points (Table 1).

In the case of incomplete (ASIA-B,C) spinal cord injury in cervical level independence has improved in using wheelchair by 3.74 ± 1.58 points, in transferring from bed to wheelchair – 3.51 ± 1.92 points. The least change in independence has been noticed in the following activities such as bathing – 2.09 ± 1.9 points, bowel control – 2.23 ± 2.24 points. In the presence of incomplete injury independence level has increased by 3 or more points in 7 out of 13 activities according to FIM. In the case of incomplete spinal cord injury the change of independence level in all kinds of activities, except ability to use wheelchair has been noticed being statistically significantly greater in comparison with the case of complete spinal cord injury according to FIM ($p < 0.05$) (Table 1).

In the case of complete (ASIA-A) spinal cord injury in thoracic-lumbar level the greatest improvement in early rehabilitation has been noticed in using wheelchair – in average 4.76 ± 1.02 points and transferring from bed to wheelchair – 3.41 ± 1.56 points. The slight change in walking upstairs – 0.27 ± 1.03 points and bowel control – 0.98 ± 1.72 points has been noticed (Table 2).

Independence of patients with incomplete spinal cord injury in early rehabilitation has increased mostly in mobility (by wheelchair or walking) – 4.1 ± 1.89 points, in dressing the lower part of the body – 3.26 ± 1.77 points. Slight improvement of independence has been noticed in bladder control – 1.46 ± 2.0 and bowel control – 1.05 ± 1.89 points.

Table 1. The improvement of functional state and activity of patients with cervical spinal cord injury in early rehabilitation evaluated by the Functional Independence Measurement

| Function | Completeness of injury | | |
|---------------------------|------------------------|---------------------|---------|
| | ASIA-A (n=21) | ASIA-B,C (n=35) | p-value |
| | points (mean±SD) | points (mean±SD) | |
| Eating | 2.43±1.5 | 3.46±1.65 | 0.015 |
| Grooming | 1.33±1.46 | 3.29±1.62 | 0.000 |
| Bathing | 0.14±0.48 | 2.09±1.9 | 0.000 |
| Dressing upper body | 1.38±1.75 | 3.4±1.77 | 0.000 |
| Dressing lower body | 0.57±1.36 | 3±1.94 | 0.000 |
| Toileting | 0.24±0.89 | 2.51±1.96 | 0.000 |
| Bladder control | 0.24±1.09 | 2.66±2.45 | 0.000 |
| Bowel control | 0.1±0.44 | 2.23±2.24 | 0.000 |
| Bed, wheelchair transfer | 1.14±1.46 | 3.51±1.92 | 0.000 |
| Toilet transfer | 0.0±0.0 | 3.09±2.23 | 0.000 |
| Shower, bathroom transfer | 0.00±0.00 | 2.86±2.26 | 0.000 |
| Mobility | 3.81±1.6 | 3.74±1.58 | 0.786 |
| Stairs climbing | 0.00±0.00 | 2.80±2.06 | 0.000 |
| Total | 11.38±8.5 | 38.63±19.84 | 0.000 |

The comparison of the change in level of independence between patients with incomplete and complete spinal cord injury in thoracic-lumbar level showed a statistically significant increase in independence for these activities in the case of incomplete injury: bathing, toileting, transferring in bathroom and walking upstairs. In other activities according to FIM the chan-

ge in independence was not statistically significantly greater (Table 2).

The comparison of independence level achieved by patients at the end of early rehabilitation period and expected level of final rehabilitation according to the level of injury has shown that in the case of complete spinal cord injury in cervical level (C4-C8)

Table 2. The improvement of functional state and activity of patients with thoracic-lumbar spinal cord injury in early rehabilitation evaluated by the Functional Independence Measurement

| Function | Completeness of injury | | |
|---------------------------|------------------------|---------------------|---------|
| | ASIA-A (n=41) | ASIA-B,C (n=39) | p-value |
| | points (mean±SD) | points (mean±SD) | |
| Eating | 1.49±1.4 | 1.15±1.46 | 0.21 |
| Grooming | 1.68±1.29 | 1.46±1.64 | 0.24 |
| Bathing | 1.15±1.33 | 2.15±1.83 | 0.01 |
| Dressing upper body | 3.34±1.61 | 3.00±1.73 | 0.39 |
| Dressing lower body | 2.59±1.92 | 3.26±1.77 | 0.15 |
| Toileting | 1.12±1.52 | 2.51±1.85 | 0.002 |
| Bladder control | 1.83±2.21 | 1.46±2.00 | 0.63 |
| Bowel control | 0.98±1.72 | 1.05±1.89 | 0.89 |
| Bed, wheelchair transfers | 3.41±1.56 | 3.26±1.9 | 0.881 |
| Toilet transfer | 1.05±1.67 | 2.49±2.2 | 0.004 |
| Shower, bathroom transfer | 0.98±1.67 | 2.56±2.21 | 0.002 |
| Mobility | 4.76±1.02 | 4.10±1.89 | 0.35 |
| Stairs climbing | 0.27±1.03 | 2.23±2.25 | 0.00 |
| Total | 24.7±9.77 | 30.69±15.32 | 0.0505 |

Table 3. Distribution of patients according to an achieved level of independence in early rehabilitation using the Functional Independence Measurement*

| Level of injury | Expected points | ASIA-A | | | ASIA-B, C | | | Total number of patients |
|-----------------|-----------------|-------------------------|--|-----------------|-------------------------|--|-----------------|--------------------------|
| | | Mean of achieved points | Patients who achieved expected level n (%) | All patients, n | Mean of achieved points | Patients who achieved expected level n (%) | All patients, n | |
| C4 | 14 | 14.5 | 2 (100) | 2 | 33.6 | 6 (85.7) | 7 | 9 |
| C5 | 18–20 | 16.2 | 3 (33.3) | 9 | 45.4 | 11 (100) | 11 | 20 |
| C6 | 22–34 | 22.7 | 5 (71.4) | 7 | 44.0 | 7 (87.5) | 8 | 15 |
| C7-8 | 35–57 | 38.0 | 1 (100) | 1 | 51.0 | 10 (100) | 10 | 11 |
| T1-9 | 58–61 | 38.0 | 0 (0) | 24 | 42.6 | 0 (0) | 14 | 38 |
| T10-L1 | 59–61 | 40.1 | 0 (0) | 17 | 49.4 | 0 (0) | 19 | 36 |
| L2-S5 | 60–61 | 44.5 | 0 (0) | 2 | 48.0 | 0 (0) | 5 | 7 |
| Total | | | 11 (17.7) | 62 | | 34 (45.9) | 74 | 136 |

* – 9 activities evaluated by FIM.

the expected level was achieved by 33.3–100% of patients. In the case of incomplete injury the expected level was achieved by 87.5–100% of patients (Table 3). No patient with spinal cord injury in thoracic-lumbar (Th1-S5) level has achieved expected level of independence of final rehabilitation in early rehabilitation period.

Discussion

Patients with spinal cord injury suffer from motor and sensory deficits and dysfunction of bladder and bowel (8, 9). It is important to start complex rehabilitation immediately after stabilization of patient's functional status (10). G. M. Yarkony and others state that recovery of functional ability after spinal cord injury is faster during an inpatient rehabilitation period and is dependent on neurological restoration, intensity of rehabilitation procedures and complex problem solving (11). In our study intensive complex rehabilitation was started immediately after the transfer to the Department of Rehabilitation. T. Fujiwara and Y. Hara (12) agree that the neurological level is the most important factor for predicting functional outcome. Our study has shown that neurological level and level of injury are most important factors for functional outcomes. Our study has shown that patients with

paraplegia did not achieve expected independence level. It was unexpected for us that patients with incomplete injury in thoracic-lumbar injury did not achieve expected level of independence. Similar results have been obtained by other authors as well, when patients with spinal cord injury in thoracic-lumbar level did not achieve expected level of independence based on the theoretical models (8). It could be due to the fact that the expected level of independence of patients with spinal cord injury in thoracic-lumbar level is significantly higher and a longer rehabilitation period is needed for its achievement.

Conclusions

1. Patients with spinal cord injury had disturbances of all activities according to Functional Independence Measure.
2. The grade of spinal cord injury had greater influence on the level of independence of patients with injury in cervical level rather than in thoracic-lumbar level.
3. During occupational therapy the expected level of independence in early rehabilitation period was achieved in 17.7% of cases with complete spinal cord injury and in 45.9% of cases with incomplete spinal cord injury.

Ergoterapija po nugaros smegenų pažeidimo ankstyvojo reabilitacijos etapu

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Raktažodžiai: nugaros smegenų pažeidimas, reabilitacija, savarankiškumas, ergoterapija.

Santrauka. *Tikslas.* Nustatyti veiksnius, kurie turi įtakos ergoterapijos, taikomos po nugaros smegenų pažeidimo, efektyvumui ankstyvuoju reabilitacijos etapu.

Tyrimo medžiaga ir metodai. Tirti 136 pacientai, patyrę nugaros smegenų pažeidimą ir reabilituoti Kauno medicinos universiteto klinikų Reabilitacijos klinikos Neuroreabilitacijos poskyryje 1999–2005 metais. Vyrų sudarė 71,3 proc. (97), moterų – 28,7 proc. (39). Kompleksinė reabilitacija pradėta stabilizavus paciento būklę neurochirurgijos klinikoje ir perkėlus į neuroreabilitacijos poskyrį. Vidutinė ankstyvosios reabilitacijos neuroreabilitacijos poskyryje trukmė – $68,3 \pm 22,5$ dienos. Pagal nugaros smegenų pažeidimo lygį pacientai suskirstyti į patyrusius: kaklo srities pažeidimą (C1-Th1 segmentai) ir krūtinės–juosmens srities pažeidimą (Th2-S1 segmentai). Pagal nugaros smegenų pažeidimo laipsnį pacientai suskirstyti į patyrusius: visišką pažeidimą (ASIA-A) ir dalinį pažeidimą (ASIA-B, ASIA-C). Ligonų savarankiškumas buvo vertintas atsižvelgiant į nugaros smegenų pažeidimo lygį: C4; C5; C6; C7-C8; Th1-Th9; Th10-L1; L2-S5 segmentuose. Tiriamųjų funkcinė būklė ir veiklos sutrikimai vertinti taikant funkcinio nepriklausomumo testą. Ergoterapijos efektyvumas vertintas: geras, jei ligonis pasiekė prognozuojamą baigtinės reabilitacijos savarankiškumą, nepakankamas, jei prognozuots savarankiškumas nepasiektas.

Rezultatai. Ištyrus pacientus, visiškas nugaros smegenų pažeidimas (ASIA-A) kaklo srityje nustatytas 21 (15,4 proc.), krūtinės–juosmens srityje – 41 (30,2 proc.), dalinis nugaros smegenų pažeidimas (ASIA-B,C) kaklo srityje nustatytas 35 (25,7 proc.), o krūtinės–juosmens srityje – 39 (28,7 proc.) pacientams. Ankstyvojo reabilitacijos etapo pabaigoje, esant visiškam nugaros smegenų pažeidimui kaklo srityje (C4–C8), prognozuojamą savarankiškumą pasiekė 33,3–100 proc., o dalinį – 87,5–100 proc. pacientų. Kai nugaros smegenys buvo pažeistos krūtinės–juosmens (Th1-S5) srityje, nė vienas pacientas ankstyvuoju reabilitacijos etapu nepasiekė prognozuojamo baigtinės reabilitacijos savarankiškumo.

Išvados. Pacientams po nugaros smegenų pažeidimo ankstyvuoju reabilitacijos etapu nustatytas visų veiklų pagal funkcinio nepriklausomumo testą sutrikimai. Nugaros smegenų pažeidimo laipsnis pacientų savarankiškumui turėjo didesnės įtakos, kai pažeidimas buvo kaklo srityje palyginus su pažeidimu krūtinės–juosmens srityje. Savarankiškumo lygis ankstyvuoju reabilitacijos etapu siekė 17,7 proc., esant visiškam nugaros smegenų ir 45,9 proc. – daliniam nugaros smegenų pažeidimui.

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