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The Importance of Rehabilitation Programs Using Balneary Treatments in Patients with Spinal Cord Injury

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Abstract: The rehabilitation tools that are designed to improve the function of patients with spinal cord injury (SCI) have various effects. The goals of rehabilitation are to prevent secondary complications, maximize physical functioning, and integrate them into the community. The objective of this study is to evaluate the functional and neurological outcomes of patients with SCI after in-patient rehabilitation in a balneary unit. Methods: one hundred forty-two patients, admitted for primary rehabilitation in a two-year period (2020–2021), aged ≥18 years with SCI, divided into traumatic SCI (T-SCI) and nontraumatic SCI (NT-SCI). The following demographic information was collected: gender, age, studies, occupation, and environment. All patients underwent an initial clinical examination which included diagnosis, causes of SCI, medication, Carmeli score, fall risk, Visual Analogue Scale (VAS) for pain, Functional Independence Measure Motor (FIMm), Functional Independence Measure Cognitive (FIMc), and Functional Independence Measure Total (FIMt). At discharge, the fall risk, VAS, FIMm, FIMc, and FIMt were analyzed. We compared the results between the two groups. Results: T-SCI group was 65 (45.77%) and the NT-SCI group was 77 (54.23%). The study analyzed the effects of rehabilitation on the functional presentation of patients with SCI. It also compared the effects of rehabilitation on T-SCI versus NT-SCI on different outcomes such as age, gender, and clinical–functional impairment. Conclusions: Physical medicine and rehabilitation increase the autonomy of patients. Neurological improvement begins in the first 10 days of complex rehabilitation treatment and is not significantly different between the two groups. The cause of the injury in SCI does not affect the results of the rehabilitation.

Keywords: traumatic; nontraumatic; spinal cord injury; fall risk; VAS; Carmeli; FIM; rehabilitation

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1. Introduction

The spinal cord is the main pathway for communicating with the rest of the body. It is damaged by a spinal cord injury (SCI), which disrupts the signals that the brain sends to the body. Most SCIs happen when a blow breaks or dislocates the bones that make up the spine. They can also cause damage by fragments of vertebrae hitting the nerve tissue [1].

SCIs can result from damage to the vertebrae, ligaments, or disks of the spinal column, or to the spinal cord itself, and can be divided into two subgroups on the basis of their etiology: traumatic and nontraumatic. A traumatic spinal cord injury (T-SCI) can stem from

a sudden, traumatic blow to the spine that fractures, dislocates, crushes, or compresses one or more of the vertebrae. It can also result from a gunshot or knife wound that penetrates and cuts the spinal cord. A nontraumatic spinal cord injury (NT-SCI) is a serious injury that can cause significant damage to the cord. It can be caused by various factors such as arthritis, cancer, and disk degeneration [1].

Spinal cord and neck injuries are common causes of disability among young healthy individuals. The cost of care and rehabilitation for these injuries can bring important socioeconomic consequences. Over the past several decades, the mean age of the spinal cord-injured patients has increased, which is attributed to a substantially greater proportion of injuries related to falls in the elderly. Cervical spine injuries, of which approximately one-third occur in the craniocervical junction [2], account for the majority of the spinal injuries, followed by thoracolumbar fractures. Almost half of the spinal injuries result in neurological deficits, often severe and sometimes fatal. Survival is inversely related to the patient's age and neurologic level of injury, with lower overall survival for high quadriplegic patients compared to paraplegic injuries [2].

An SCI is a medical emergency. Immediate treatment can reduce the long-term effects. Treatments may include drug treatment, braces or traction to stabilize the spine, and surgery. Later treatment usually includes pharmaceutical treatment and rehabilitation therapy. Mobility aids and assistive devices may help to get around and do some daily tasks [3].

The quality of life for individuals with an SCI is often influenced by various factors such as physical health, socioeconomic status, and complications [4]. The interventions that are focused on reducing these secondary injuries and complications have a variety of goals. In addition to the conventional drug management, robotic-assisted locomotor training, gait training strategies, specific exercises (including hydrokinetotherapy), functional electrical stimulation devices, and repetitive transcranial magnetic stimulation devices are universally recommended to improve function in persons with SCIs [4].

The primary goals of rehabilitation are the prevention of secondary complications, the maximization of physical functioning, and reintegration into the community [3]. Rehabilitation following an SCI is most effectively undertaken with a multidisciplinary, team-based approach, as follows [3,5]: physical therapists typically focus on lower-extremity function and on difficulties with mobility, occupational therapists address upper-extremity dysfunction and difficulties in activities of daily living, rehabilitation nurses are concerned with the issues of bowel and bladder dysfunction and the management of pressure injuries (pressure ulcers), psychologists deal with the emotional and behavioral concerns of the newly injured patient and with any potential cognitive dysfunction, speech-language pathologists address with issues of communication and swallowing, case managers and social workers are the primary interface between the rehabilitation team, the patient, and his or her family, and the payer source. The rehabilitation team functions under the direction of a physiatrist (a physician who specializes in physical medicine and rehabilitation) or a physician with a subspecialty certification in spinal cord medicine [5,6]. So, an SCI is a serious disease that can cause various aspects of a patient's life to significantly deteriorate. The primary goal of rehabilitation is to improve a patient's functional level and decrease their secondary morbidity. In this paper, we tried to determine the importance of rehabilitation as a part of the therapeutic management of patients with SCIs in order to evaluate the functional and neurological status at admission and discharge, and factors associated with functional status among patients with traumatic and nontraumatic SCIs.

2. Materials and Methods

2.1. Study Model

We performed a retrospective cohort study that analyzed the full medical records of 142 patients in a two-year period (1 January 2020–31 December 2021), admitted for primary rehabilitation in a single center, Balneal and Rehabilitation Sanatorium Techirghiol (BRST), Romania. The unit is representative of Romania's medical rehabilitation services,

being a single-specialty hospital with a total of 935 hospital beds and using natural saline water. All the subjects provided the agreement to participate in this study. The study was approved by the Sanatorium Ethical Committee (approval no. 1733 from 2 February 2022) and complied with the revised ethical guidelines of the Declaration of Helsinki. Patients were diagnosed and referred to BRST by the neurologist and the family physician who established the diagnosis.

2.2. Study Population

Patients were selected based on the following inclusion criteria: free consent, based on the explanation and understanding, respectively, of all related procedural steps; age over 18 years; traumatic and nontraumatic spinal cord injury. The exclusion criteria were: neurological diseases of infectious cause during the period of contagion; multiple sclerosis; commitment; decubitus ulcer; pregnancy and/or lactation; uncompensated organ/apparatus sufferings: cardiovascular, hepatic, renal, respiratory; major psycho-organic and/or psychiatric suffering. All patients included in the group followed a standard daily treatment for 10 days which included a major procedure of hydrokinetotherapy in saline water (the water of Techirghiol lake, which is strongly hypertonic, and has a concentration of about 80 g of mineral salt per liter and total mineralization of 52 g/L) and three minor procedures: electrotherapy, massage, and kinesiotherapy [7]. The following demographic information was collected: gender, age, studies, occupation, and environment. All patients underwent an initial clinical examination which included diagnosis, causes of SCI, medication, Carmeli score, fall risk, Visual Analogue Scale (VAS) for pain, Functional Independence Measure Motor (FIMm), Functional Independence Measure Cognitive (FIMc), and Functional Independence Measure Total (FIMt). At discharge, we analyzed the fall risk, VAS, FIMm, FIMc, and FIMt (the procedures used in the evaluation of the patients in the study are those used in our hospital, according to the internal work protocols, and the protocols are established by the department head doctors, according to the recommendations of the quality control organization in Romania). We compared the results between the two groups.

2.3. Study Objectives

This study was conducted to be a descriptive study about T-SCI and NT-SCI patients, in terms of their demographic and neurological features, the causes of the SCI, the medication, and the Carmeli score in order to investigate the efficient results of rehabilitation. The second aim of the study was to conduct a comparison between T-SCI patients and NT-SCI patients regarding changes in functional status: fall risk, VAS, FIMm, FIMc, and FIMt after 10 days of a complex rehabilitation program.

2.4. Data Analysis

The statistical analysis was performed using International Business Machines Corporation-Statistical Package for the Social Sciences (IBM SPSS) statistics software version 23. Data are presented as mean $\pm$ standard deviation (SD) for continuous variables in case of symmetric distributions, median and IQR (Interquartile range) for numerical discrete variables or continuous variables in case of skewed distributions, or as frequencies and percentages for categorical variables. The normality of the continuous data was estimated with Kolmogorov–Smirnov Tests of Normality. For hypotheses testing: Independent Samples Mann–Whitney U test, Independent Samples Median test, Related Samples Wilcoxon Signed Rank Test, Chi-Square Test of association, and the Chi-Squared test for the comparison of two proportions were used depending on the type of analyzed variables. The probability of a Type I error (the significance level α) was set at 0.05. If the test statistic for every conducted test was in the critical region, and the p-value was less than or equal to the significance level, we decided to reject the null hypothesis in favor of the alternative hypothesis.

3. Results

3.1. Study Population

Medical records from 142 patients were reviewed; they consisted of 65 (45.77%) T-SCI patients and 77 (54.23%) NT-SCI patients. Demographic characteristics are presented in Table 1. The average age of the T-SCI patients was 47.95 ± 14.67 years and for the NT-SCI patients, 51.56 ± 13.98 years, respectively. Patients with NT-SCI were older than patients with T-SCI (64.9% of the NT-SCI group were more than 50 years). In the T-SCI group, 16 (24.6%) of the patients were females and 49 (75.4%) were males. In the NT-SCI group, 37 (48.1%) of the patients were females and 40 (51.9%) of them were males. The majority of the patients are from a rural environment, 58 (75.3%) from NT-SCI and 42 (64.6%) from T-SCI. When the patients were evaluated on the basis of occupation/profession, which we found in the T-SCI group consisted of 8 working individuals, 34 retired individuals, 1 unemployed, and 22 with disability certificates according to Romanian law, whereas for the patients in the nontraumatic group, we found 17 working individuals, 38 retired individuals, 2 unemployed, and 22 with disability certificates. When the two groups were compared, the percentage of patients who were retired represented the majority in both groups (T-SCI 52.3% and NT-SCI 49.4%). We also analyzed the medication for both groups (Table 1) and we noticed, in the T-SCI groups, most took no medication (40%), followed by antispasmodic (35.38%), and in NT-SCI group, the representative category was antihypertensive (46.75%). Concerning the Carmeli score at admission (Table 1), we found that there were no statistically significant differences between the median values of the Carmeli Score across the categories of etiology (T-SCI/NT-SCI): $p = 0.478 > \alpha = 0.05$ (Independent Samples Median test), and also that the distribution of the Carmeli score was the same across the categories of etiology (T-SCI/NT-SCI): $p = 0.180 > \alpha = 0.05$ (Independent Samples Mann–Whitney U test).

Cause of injury in T-SCI patients (Figure 1) consisted of 28 (43.08%) road/work accidents, 18 (27.69%) direct aggression trauma, and 19 (29.23%) falls. We measured the duration of trauma in weeks (mean 19.41, standard deviation 15.64, minimum 2, maximum 84). Regarding the cause of injury in the NT-SCI (Figure 1) patients, it consisted of syringomyelia 1 (1.30%), transverse myelitis 8 (10.39%), spondylosis with myelopathy 24 (31.17%), cervical disc disorder with myelopathy 15 (19.48%), lumbar disc disorder with myelopathy 9 (11.69%), vertebral fracture other than traumatic 10 (12.99%), medullary/vertebral carcinoma 4 (5.19%), Morb Pott-operated sequelae 2 (2.60%), sequelae operated on the dorsal arteriovenous malformation 2 (2.60%), and poliomyelitis sequelae 2 (2.60%).

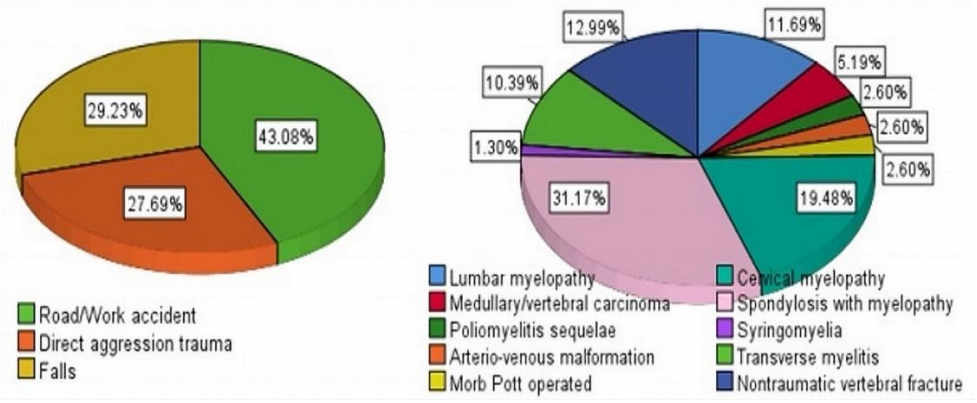

Figure 1. Causes of T-SCI (**left**) and causes of NT-SCI (**right**).

Table 1. Patients characteristics.

Variable	T-SCI (*N = 65*)	NT-SCI (*N = 77*)
Age at admission		
18–30	8 (12.3%)	6 (7.8%)
30–50	25 (38.5%)	21 (27.3%)
50–90	32 (49.2%)	50 (64.9%)
Sex		
Male	49 (75.4%)	40 (51.9%)
Female	16 (24.6%)	37 (48.1%)
Occupation		
Unemployed	1 (1.5%)	2 (2.6%)
Employed	8 (12.3%)	17 (22.1%)
Retired	34 (52.3%)	38 (49.4%)
Disability Certificate	22 (33.8%)	20 (26.0%)
Environment		
Urban	23 (35.4%)	19 (24.7%)
Rural	42 (64.6%)	58 (75.3%)
Medication		
No medication	26 (40.00%)	22 (28.57%)
Antispasmodics	23 (35.38%)	10 (12.99%)
Antihypertensive	18 (27.69%)	36 (46.75%)
Lipid-Lowering Drugs	3 (4.62%)	7 (9.09%)
NSAID	2 (3.08%)	3 (3.09%)
Pain relievers	3 (4.62%)	0 (0.00%)
Myorelaxants	8 (12.31%)	6 (7.79%)
Food supplements	16 (24.62%)	11 (14.29%)
Antidiabetics drugs	2 (3.08%)	2 (2.60%)
Psychiatric medication	2 (3.08%)	3 (3.90%)
Anticonvulsants	4 (6.15%)	5 (6.49%)
Carmeli Score		
Mean ± SD	1.78 ± 0.52	1.68 ± 0.64
Median	2.00	2.00
Range	1.00	1.00

Abbreviations: T-SCI: traumatic spinal cord injury; NT-SCI: nontraumatic spinal cord injury; NSAID: nonsteroidal anti-inflammatory drugs; SD: standard deviation.

3.2. Clinical–Functional Status

Regarding the functional status, we analyzed the evolution of the fall risk, VAS, FIMm, FIMc, and FIMt at admission and discharge.

We found statistically significant differences between the median values of each variable across categories of etiology (T-SCI/NT-SCI): $p < 0.001 < \alpha = 0.05$ (Independent Samples Median test), and we also found that the distribution of scores for each variable was not the same across categories of etiology (T-SCI/NT-SCI): $p < 0.001 < \alpha = 0.05$ (Independent Samples Mann–Whitney U test), separately at admission and at discharge. So, comparing the two groups from the point of view of the clinical–functional parameters analyzed in the dynamics, we note that patients with traumatic lesions and nontraumatic lesions showed a significant increase of FIMm, FIMc, and FIMtm, FIMc, and FIMt ($p < 0.05$). Moreover, the decrease in fall risk and VAS were statistically significant in both groups after 10 days of treatment ($p < 0.05$).

In the following, for each clinical–functional variable (Table 2), we will detail the evolution, specifying for each: minimum (min), maximum (max), mean, median, and IQR.

Table 2. Clinical–functional parameters of T-SCI/NT-SCI.

Etiology		Mean	Median	Standard Deviation	Minimum	Maximum	IQR
T-SCI	Fall risk at admission	3.78	3.00	1.92	1.00	7.00	3.00
	Fall risk at discharge	3.52	3.00	1.97	0.00	7.00	3.00
	VAS at admission	3.95	5.00	2.85	0.00	9.00	5.50
	VAS at discharge	2.42	3.00	1.89	0.00	8.00	2.50
	FIMm at admission	18.12	20.00	6.42	6.00	27.00	12.00
	FIMm at discharge	18.51	21.00	6.24	9.00	27.00	12.00
	FIMc at admission	11.42	12.00	1.48	8.00	13.00	3.00
	FIMc at discharge	11.58	12.00	1.39	8.00	13.00	2.00
	FIMt at admission	29.22	32.00	8.00	13.00	40.00	14.50
	FIMt at discharge	29.65	33.00	7.80	15.00	40.00	15.00
NT-SCI	Fall risk at admission	2.44	2.00	2.18	0.00	8.00	2.00
	Fall risk at discharge	2.27	2.00	2.15	0.00	8.00	2.00
	VAS at admission	5.91	6.00	2.24	0.00	10.00	2.00
	VAS at discharge	3.12	3.00	1.62	0.00	7.00	2.00
	FIMm at admission	21.61	23.00	5.78	8.00	28.00	5.00
	FIMm at discharge	22.12	23.00	5.71	9.00	28.00	4.50
	FIMc at admission	12.08	12.00	1.13	9.00	13.00	1.00
	FIMc at discharge	12.14	13.00	1.13	9.00	13.00	1.00
	FIMt at admission	33.38	35.00	7.43	12.00	41.00	7.00
	FIMt at discharge	33.40	35.00	8.07	4.00	41.00	6.00

Abbreviations: T-SCI: traumatic spinal cord injury; NT-SCI: nontraumatic spinal cord injury; VAS: Visual Analogue Scale; FIMm: Functional Independence Measure Motor; FIMc: Functional Independence Measure Cognitive; FIMt: Functional Independence Measure Total; IQR: interquartile range

Fall risk (Figure 2) at admission was higher in the T-SCI group versus the NT-SCI group, while VAS (Figure 3) at admission was lower in the T-SCI group than in the NT-SCI group. At discharge, both parameters, fall risk and VAS, decreased in both the T-SCI group and the NT-SCI group.

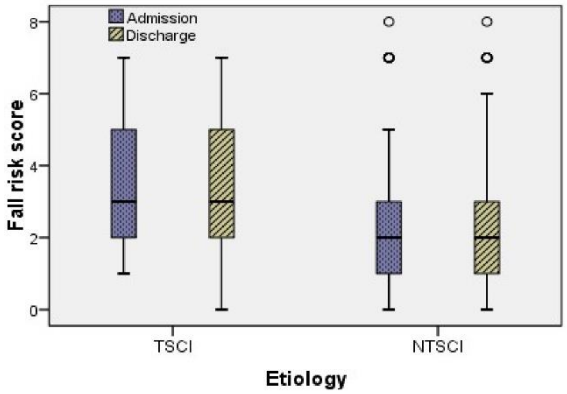

Figure 2. The distribution of fall risk scores across categories of etiology (T-SCI/NT-SCI).

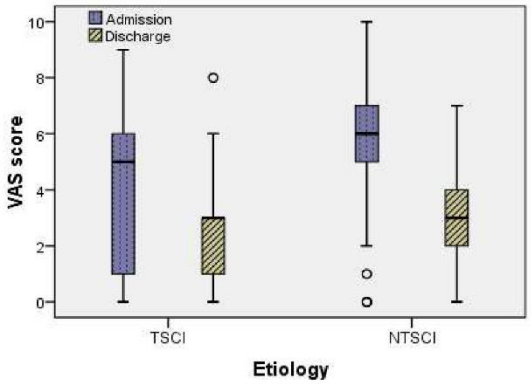

Figure 3. The distribution of VAS scores across categories of etiology (T-SCI/NT-SCI).

In the traumatic group, we analyzed the values of the FIMm scores (Figure 4) at admission and at discharge. In the nontraumatic group, the value of FIMm at admission increased at discharge. We also analyzed the FIMc (Figure 5) at admission and discharge and the results were comparable, with an increase in both groups. The comparison of the admission FIMt scores (Figure 6) between the two groups revealed that the traumatic SCI group had lower scores than the nontraumatic SCI group. Both values, the FIMt scores for T-SCI and FIMt scores for NT-SCI, increased at discharge, which were statistically significant ($p < 0.05$).

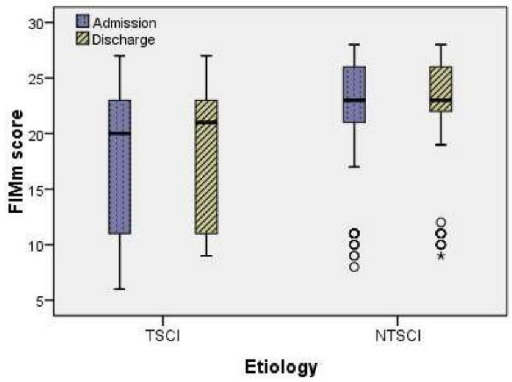

Figure 4. The distribution of FIMm scores cross categories of etiology (T-SCI/NT-SCI).

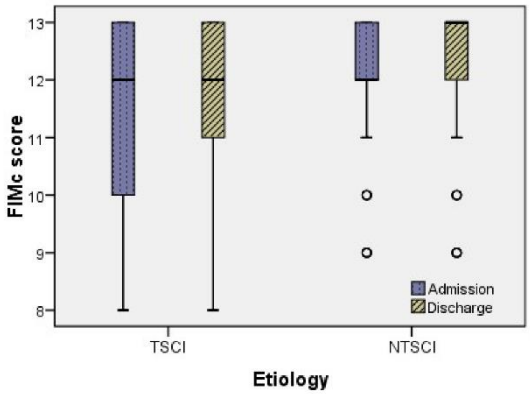

Figure 5. The distribution of FIMc scores across categories of etiology (T-SCI/NT-SCI).

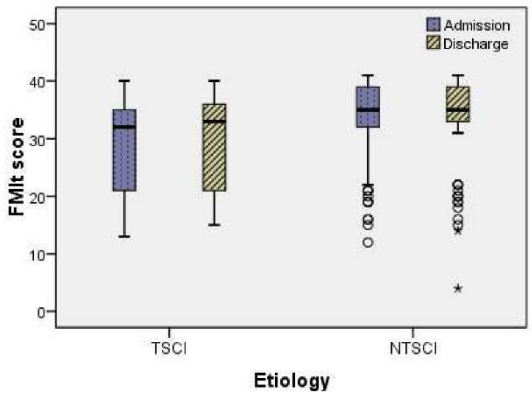

Figure 6. The distribution of FIMt scores across categories of etiology (T-SCI/NT-SCI).

4. Discussion

Rehabilitation following an acute SCI is often considered to improve a person's clinical outcomes. However, the complexity of the interventions used has made their evaluation difficult. Interdisciplinary rehabilitation refers to the treatment of multiple individuals. It can be challenging to determine which intervention can improve a person's recovery. Compared to standard rehabilitation programs, interdisciplinary programs involve the simultaneous care of multiple people. The content of rehabilitation varies depending on the context, jurisdiction, funding, or health care policy. For instance, the type of facility that accepts patients varies depending on the region and population [3].

The conditions of rehabilitation are also affected by the environment and the population. For instance, the BRST rehabilitation center is located in a region that is near the Black Sea. The facility has been providing rehabilitation services to injured individuals for over a century. Its location and services are also influenced by the area's natural cure factors. In our hospital, the daily treatment is standard: hot saline bath prescribed and performed daily as the only major hydrokinetic therapy procedure, at 35 °C, 3–4 electrotherapy procedures (direct current, low-frequency currents/pulses, functional electrical stimulation, ultrasound therapy, extracorporeal shockwave therapy, low-level laser therapy), massage therapy, and physical therapy [7].

A retrospective study was carried out to evaluate the effects of various factors on the functional and psychological outcomes of patients with severe SCIs who were admitted to a rehabilitation program. In our study, 45.77% of the patients were traumatic SCI patients. There are a few studies in the literature about the demography, incidence, and prevalence of this type of patient, and our results are in agreement with the studies already published [8–10]. Similar to the literature [8], in our study, the average age of the traumatic group was lower than the average age of the nontraumatic group. In both groups, the number of men is higher, with a proportion of 75% in the T-SCI group, probably due to the factors that commonly affected these individuals, which included falls from a high place and motor vehicle accidents. Even though in the majority of the studies men are dominant in T-SCI or in NT-SCTI patients' etiology, we found just one study which showed significant differences in the sex distribution between the different etiologies, with women more likely to have a benign tumor than men [11].

Various studies have shown that the majority of patients with severe SCIs who experienced a traumatic event were employed, while in the nontraumatic group, there was a higher number of retired patients [12]. In our study, we found similar results in nonworking, working, or retired patients. Moreover, we found the same ratio of the patients who had a disability certificate according to Romanian law. The majority of the patients are from rural areas, probably due to higher physical demands than in urban areas, as well as higher risks of accidents.

In the study, the leading factor that affected the patients with severe SCIs was road/work accidents (43.08%), followed by falls (29.23), and direct aggression (27.69%), as in other studies [8,10,13].

The major cause of injury in NT-SCI patients consisted of myelopathy with spondylosis or disc disorders, but we also identified the rare cause of NT-SCI, such as poliomyelitis sequelae (2.60%), syringomyelia (1.30%), or Morb Pott-operated sequelae (2.60%) [12,14].

Regarding the American Spinal Injury Association impairment scale (AIS), in the literature we found different results of neurological deficit, probably according to the type of hospitals in which they are treated, or due to the lengths of the disease, whether acute or chronic [15,16]. In meta-analyses and systematic reviews [17,18], we found different reports of patients included in the studies, both in terms of the AIS classification and outpatient status. Perhaps this can be explained due to the social, cultural, and genetic differences between countries, or the access to medical services and rehabilitation strategies. Also analyzing different studies, we concluded that there was a relationship between converting the AIS degree to a better one according to the severity of the SPI or intramedullary lesion length [16]. Moreover, locomotor training improves the AIS grade gait speed to levels sufficient for independent in-home or community ambulation after chronic motor incomplete SCI [19].

In the study, we also looked at the various drugs used by the patients, and the most common type of medication used was a lack of medication in T-SCI, which was a normal result considering that they are younger and healthier, while antihypertensive medication was the most commonly used in NT-SCI [20,21].

It is well known that in SCIs, the most common complication observed in both groups was a urinary tract infection. Mc Kiney et al. compared the complications between traumatic and nontraumatic SCIs and found no statistically significant differences between the two groups regarding urinary tract infections. Moreover, the authors identified other infections such as pneumonia and wound infections. It is important to determine the risk of infections at admission to a hospital because it has an important implication for the rehabilitation outcomes, individualized patient management, and long-term outcome of individuals with NT-SCI. That is why we calculated the Carmeli score, in order to identify patients susceptible to being colonized with multidrug-resistant bacteria at the beginning of the hospitalization. The highest numeric value of the three criteria represents the final value of the Carmeli score (1, 2, or 3). The final score allowed us to classify patients as follows: score 1 (community-acquired infections with microorganisms susceptible to classic antibiotics), score 2 (probably healthcare-associated or community-acquired infections but with a high probability of resistant or multidrug-resistant strains), and score 3 (maximum prediction for nosocomial infections with resistant or multidrug-resistant strains) [22]. In our study, we found a higher Carmeli score in the T-SCI group (1.78) versus the NT-SCI group (1.68), but without statistical significance. There is no data in the scientific literature regarding this score in SCIs.

An important issue to establish the rehabilitation goals is to evaluate the fall risk. Wilson et al. evaluated the falls in SCIs, acquired brain injury, and a neuromusculoskeletal disease, and the type of disease was not a significant predictor of the fall rate in the multivariable analysis, but these results may be useful when developing and timing fall prevention interventions for inpatient rehabilitation [23,24]. This is consistent with previous reports finding that most falls occur within a few weeks of admission, at 5–7 weeks. We found that the risk of falls is higher ($p < 0.05$) at admission in the T-SCI group, but the risk decreases statistically significantly in both groups ($p < 0.001$) after only 2 weeks of treatment.

We also investigated the pain, using the VAS score [25], and we found that, at admission, there were higher values in NT-SCI ($p < 0.001$), and at discharge, the score decreased in both groups ($p < 0.001$). In previous studies [8,9,26], although spasticity and neuropathic pain are quite common in both the nontraumatic and traumatic groups, these conditions were less prevalent in the nontraumatic group, even if the pain could be visceral, nociceptive, or neuropathic [27].

Regarding the functional status, we evaluated FIMm, FIMc, and FIMt. The results have shown a higher level at admission for NT-SCI for all three parameters, and all increase with a statistical significance ($p < 0.001$) in T-SCI as well as in the NT-SCI group. In our study, we noticed an improvement in the functional outcomes in nonacute SCIs, and the rising of FIM was demonstrated in acute SCIs, where significant differences ($p \leq 0.01$) were found between the groups with regard to the total admission FIM, motor admission FIM, self-care admission, and discharge FIM. [28]. The functional improvement in the rehabilitation of SCIs is sustained by most studies regardless of etiology [10,29–31], even in malignant spinal cord compression [32]. However, a recent study developed in Italy, on 112 patients, showed that nontraumatic lesions could have minor benefits after rehabilitation therapy if compared with traumatic ones. Further research is needed to clarify these issues [33].

4.1. Study Strengths

The patients underwent a complex treatment combined with physical and physiotherapy as well as treatment with balneary factors (salt water from the lake). This is an area in which many studies are needed, as there is currently not much data in the literature. Another strength is the total number of patients in the study, which is representative and the two groups are balanced. The article is produced in compliance with the ethical rules of conception and writing, respecting the deontological aspects of publishing scientific results.

4.2. Study Limitations

This study has several limitations. An important limitation is the retrospective design, which could affect the quality of the data. For instance, data were extracted from medical records that were filled out by clinical staff, and the use of administrative data can also expose the study to various deficiencies. These could include underreporting, misclassification, and missing data. The use of the FIM instead of the Spinal Cord Independence Measure for assessing the functional improvement of patients with spinal cord injury is also a limitation of this study. The retrospective nature/design of the study and the choice of FIM over SCIM for assessing functional independence exposes the study to inherent limitations and deficiencies, including the quality, accuracy, and sensitivity of the data. Moreover, the use of VAS, which is a subjective evaluation, could not give us specific details about the type of pain. The data collected in the dynamics show an improvement of the clinical–functional parameters after only 10 days of treatment, but it could be necessary for a long period of time for treatment or follow-up.

4.3. Facts and Perspectives

The study opens new research perspectives in neurorehabilitation and all the data indicated that the therapeutic and preventive measures should be based on the characteristics of different groups, while public policies aimed at preventing injuries should focus on high-risk populations [34].

5. Conclusions

The physical medicine and rehabilitation increases the autonomy of patients. Neurological improvement begins in the first 10 days of complex rehabilitation treatment and is not significantly different between the two groups. The cause of the injury in the SCI does not affect the results of the rehabilitation.

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