

PAIN & AGING SECTION

Original Research Article

Pain in Postsurgical Orthopedic Rehabilitation: A Multicenter Study

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Disclosure: None of the authors report conflicts of interest with respect to the conduct or findings of this study.

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Abstract

Objective. The aim of this study was to quantify and characterize pain in patients undergoing lower limb

postsurgical orthopedic rehabilitation and to investigate the impact of pain in slowing or interrupting their rehabilitation.

Design. The study was designed as a multicenter cross-sectional study.

Setting. The study was set in rehabilitation departments of the Don Gnocchi Foundation.

Subjects. The study subjects were the inpatients attending rehabilitation.

Interventions. There were no interventions used in the study.

Outcome Measures. Pain intensity was measured with a numeric rating scale (NRS); pain characteristics were assessed with the McGill Pain Questionnaire and the ID Pain (able to discriminate nociceptive from neuropathic pain). Quality of life (QoL) was measured with the Short Form 36 Health Status Survey. A semi-structured questionnaire on pain occurrence, impact, and management was administered by the physiotherapist in charge of the patients and by the physician.

Results. We studied 139 patients, 82% of whom complained of at least moderate pain (NRS ≥ 3). According to ID pain, 45.6% patients complained of probable (33.8%) or highly probable (11.8%) neuropathic pain. A higher pain intensity was significantly related to the probability of having neuropathic pain ($P < 0.001$). Patients with more severe pain reported lower physical and mental QoL scores. In 38.6% of cases, pain interfered with the rehabilitation process, and in 18.5% it was the cause of physical therapy discontinuation.

Conclusions. In light of the high occurrence and intensity of pain in the sample, and of the significant impact on the rehabilitation program, clinicians should pay more attention to pain, especially neuropathic pain, in postsurgical patients. Tailored pain pharmacological therapy could possibly improve

patient compliance during the rehabilitation process and enhance long-term outcomes.

Key Words. Pain; Orthopedic; Lower Limb; Surgery; Rehabilitation; Quality of Life

Introduction

Post-traumatic and elective orthopedic surgery is steadily increasing with procedures requiring a considerable amount of health care resources [1]. Clinical guidelines recommend a multidisciplinary approach to rehabilitation following major orthopedic surgery [2,3]; the rehabilitation process should start with early postoperative management and include pain assessment and monitoring [4]. Although physicians are currently paying more attention to orthopedic pain management [5–7], prior research has focused on acute preoperative and postoperative pain rather than on pain interfering with the rehabilitation process [8–10]. Pain is a physiological response to a noxious stimulus that makes us aware of the presence of actual or potential tissue damage, but it may also become a major and limiting complaint, and in postsurgical orthopedic patients pain relief represents an important clinical outcome [5]. Pain is actually one of the most feared postoperative complications and a significant predictor of dissatisfaction in patients undergoing rehabilitation for hip/knee replacement [11,12]. While several authors have described the clinical course and functional outcome of pain in patients undergoing surgical procedures [1,12], to date, only a few data on the type and cause of pain in these patients have been reported, and the effect of pain on patients' rehabilitation has been scarcely investigated [8]. A better knowledge of the specific types of pain and their associated effects could have relevant implications in the pharmacological pain management of these patients.

A multimodal pain approach is, by itself, capable of reducing the length of hospitalization after hip and knee replacement, while individual pain tolerance may represent a key factor for functional recovery, especially in accelerated rehabilitation programs [13]. Thus, understanding and treating pain should be a priority in orthopedic postoperative rehabilitation in order to improve patient satisfaction and function, while accelerating the rehabilitation process.

The Don Carlo Gnocchi Foundation is a not-for-profit rehabilitation institution including 29 centers throughout Italy, and this first multicenter study is part of an ongoing quality improvement process [14]. The main objectives of this study, involving seven Don Gnocchi Centres, were to quantify and characterize pain in a wide sample of patients undergoing lower limb postsurgical orthopedic rehabilitation and to investigate the interaction between pain and rehabilitation.

Methods

Study Design

The study was approved by the local ethical committee.

This is a cross-sectional study on inpatients admitted to the rehabilitation department.

All patients admitted to our rehabilitation department consented to the analysis of personal data, outcome measures, and to the rehabilitation program proposed. The protocol we adopted contains almost all the scales used when providing routine clinical care to patients cared for in the centers. We added the McGill Pain Questionnaire and ID Pain (for a better definition of pain) and Short Form 36 Health Status Survey (SF-36; to acquire data about patients' quality of life [QoL]).

Patients

All inpatients attending major lower limb postsurgical orthopedic rehabilitation (in the second week of November 2009) were enrolled in seven centers of the Don Gnocchi Foundation.

Patients were admitted to rehabilitation wards following an acute-care hospital admission.

We excluded patients with decreased cognitive function (Mini Mental State Examination <24) because of concerns about the reliability of self-report from these individuals, patients who refused to fill in the patient-oriented questionnaire, and patients with polytrauma.

Seven physicians (one from each division of our centers) enrolled study patients. Information regarding patients' demographic characteristics (age, sex, body mass index [BMI], educational level), historical data (time from surgery, time from rehabilitation onset), and associated comorbidities (diabetes, arterial hypertension and/or cardiovascular disease, arthrosis) were recorded. The therapists gave input on pain interference with rehabilitation after 1 week from the admission to the study (when all the other data were collected, see later).

Measures

Comorbidity Measure

Comorbidity was assessed with the Cumulative Illness Rating Scale (CIRS) for geriatric patients. The CIRS is a short, valid, and reliable tool to assess an individual's health condition involving 14 body systems, including heart, hypertension, vascular and respiratory disorders, eye-ear nose-throat, upper and lower gastrointestinal system, hepatobiliary system, kidneys, genitourinary diseases, musculoskeletal diseases, endocrine/metabolic disorders, nervous system, and behavioral-psychiatric disorders. Each item was rated by the physician with a 5-point Likert severity scale ranging from 0 = no abnormalities to 4 = life threatening. The Severity Index (CIRS-SI) is the sum of scores of the single items, ranging from 0 to 56, while the Comorbidity Index (CIRS-CI) is the number of involved organ areas scoring from 2 (moderate) to 4 (life threatening), ranging from 0 to 14 [15,16].

Pain Measures

We used the following pain measures: numeric rating scale (NRS), ID Pain, and McGill Pain Questionnaire.

The NRS (range 0–10) measures the intensity of pain, with a score ranging from 0 (no pain) to 10 (the worst imaginable pain) [17–19].

ID Pain is a 6-item self-administered questionnaire developed by Portenoy to discriminate neuropathic from nociceptive pain [20]. The questionnaire includes the following six questions: 1) “Did the pain feel like pins and needles?”; 2) “Did the pain feel hot/burning?”; 3) “Did the pain feel numb?”; 4) “Did the pain feel like electrical shocks?”; 5) “Is the pain worse when in contact with clothing or bed sheets?”; and 6) “Is the pain limited to your joints?”. “Yes” answers to questions 1–5 are scored as 1, while a “yes” answer to question 6 is scored as –1. Higher scores suggest the presence of neuropathic pain [20]. Cut-off scores were employed to minimize false negatives (sensitivity) in relation to false positives (specificity), and were as follows: neuropathic pain very likely (score = 4 or 5), neuropathic pain likely (score = 2 or 3), neuropathic pain possible (score = 1), and neuropathic pain unlikely (score = 0 or –1).

The McGill Pain Questionnaire, Italian version [21], was used for the multidimensional assessment of pain. The McGill Pain Questionnaire consists of three major classes of word descriptors—sensory (S), 1–10; affective (A), 11–15; evaluative (E), 16; and miscellaneous (M), 17–20 that are used by patients to specify subjective pain experience. The rank value for each descriptor is based on its position in the word set. The sum of the rank values is the pain rating index (PRI), ranging from 0 (no pain) to 78, maximum pain score. The higher the pain score the more severe the pain. The Questionnaire includes also a present pain intensity (PPI) scale scoring 0 no pain, 1 mild; 2 discomforting; 3 distressing; 4 horrible; 5 excruciating. In this study we reported the PRI.

QoL Measures

The health-related QoL was measured using the validated Italian version of the SF-36 [22], a self-administered short instrument scoring 0 to 100, including 4 physical and 4 mental dimensions. This questionnaire assesses eight specific categories of physical and emotional functioning (Physical Function, Physical Role, Bodily Pain, General Health, Vitality, Social Function, Emotional and Mental Health Role), which are summed to generate two main scores: the Physical Composite Score (PCS) and Mental Composite Score (MCS). The score for each category ranges from 0 to 100. A low PCS value indicates severe physical dysfunction, distressful bodily pain, frequent tiredness and unfavorable evaluation of health status. A low MCS indicates frequent psychological distress, and severe social disability due to emotional problems. Patients were asked to provide SF-36 responses based

on how they were doing over the last 7 days, otherwise their responses could be influenced by surgical pain.

Pain pattern during rehabilitation was assessed using forms developed by the study investigators that included two structured questionnaires; one for treating therapists and the other for treating physicians.

The instrument completed by physicians collected information regarding participants’ use of analgesic medications, pain history, rehabilitation program, and walking performance, and was administered at the time of patients admission to the study. Note that only the patients who had been in our rehabilitation department for at least a week were admitted to the study. The mean latency from the beginning of rehabilitation to the time of admission to the study was about 15 days (see Table 1).

The form completed by the physical therapists assessed the relationship between their patients’ pain and rehabilitation performance, as well as between their pain and patients’ compliance with rehabilitation treatment. This form was completed on a daily basis for the study period (1 week) and was used to determine the number of sessions/days in which the patient modified the rehabilitation on account of pain, with a particular focus on two conditions: 1) reduction of load on the joint or the intensity of exercise; and 2) rehabilitation discontinuation (when the rehabilitation session had to be stopped because of patients’ complaints of persistent pain, even though the load or the intensity of exercise had already been reduced).

All data (including pain and QoL questionnaires) were collected from the physician on admission to the study, except the data concerning pain during rehabilitation (therapist form).

Statistical Analysis

All statistical analyses were performed using the STATSOFT (Tulsa, OK, USA) package. Because of ordinal measures, nonparametric analyses were performed. We used the Spearman’s rank correlation coefficient for the correlation between the validated pain and QoL measures. To better understand which factors might interfere with rehabilitation, we created a binary variable which assumes a value of 1 for those patients who had to interrupt/modify their rehabilitation on account of pain and 0 for all those where pain did not interrupt or modify the patient’s course of rehabilitation. We were specifically interested in pain intensity as a predictor of rehabilitation modification/interruption, but we wanted to verify if other covariates had any influence. We used logistic regression to investigate the influence of the following factors on the probability of interrupting/modifying rehabilitation: gender (male/female), age (in years), surgical type (fixation vs replacement) and site (hip vs knee), latency from surgery (measured in days), latency from rehab program onset (measured in days), comorbidity (measured by CIRS), pain

Table 1 Patients' characteristics, historical data, comorbidities, pain, and QoL scores

Sample (N)		N = 139
Patient characteristics	Mean age in years (SD)	72.8 (11.0)
	Female, %	69.8%
	Mean body mass index (SD)	24.3 (4.1)
	Mean educational level (SD)	14.2 (1.9)
	Mean latency from surgery to admission in rehabilitation department in days (SD)	14.6 (13.7)
	Mean latency between onset of rehabilitation and admission to study in days (SD)	14.7 (12.1)
Comorbidities	Diabetes, %	12.2%
	Arterial hypertension and/or cardiovascular disease, %	42.6%
	Arthrosis, %	59%
	Mean CIRS severity score (SD)	7.7 (4.2)
	CIRS comorbidity (mean, SD)	4.2 (2.1)
Pain tools	Mean McGill score, range 0–78 (SD)	38.9 (27.8)
	Mean NRS score, range 0–10 (SD)	4.9 (2.4)
	Mean ID PAIN score, range –1–5 (SD)	1.6 (1.6)
QoL tool	Mean SF-36 PCS score, range 0–100 (SD)	28.3 (8.4)
	Mean SF-36 MCS score, range 0–100 (SD)	43.6 (11.7)

CIRS = Cumulative Illness Rating Scale; MCS = Mental Composite Score; NRS = numeric rating scale; PCS = Physical Composite Score; QoL = quality of life; SD = standard deviation; SF-36 = Short Form 36 Health Status Survey.

medication (nonsteroidal anti-inflammatory drugs, opioids, or both), and pain scores (measured using the NRS and ID pain scores).

Results

During the period of the study 158 patients with major lower limb postsurgical orthopedic were approached and 15 were excluded because of dementia (N = 10) and polytrauma (N = 5). Of the 143 patients that met inclusion criteria, three did not provide consent, and one patient did not speak Italian, leaving 139 patients in the final sample. The mean age of the sample was 72.8 (range 36–95), 69.8% were women, and 74.8% had undergone either hip or knee replacement.

Table 1 shows patients' characteristics (age, sex, BMI, level of education, historical data (time from surgery, time from rehabilitation onset) and comorbidities (diabetes, arterial hypertension and/or cardiovascular disease, arthrosis). Eighty-two percent complained of at least moderate pain (NRS ≥ 3) in the site of orthopedic surgery, while 5.9% had no pain at all (Figure 1).

Table 2 summarizes pain results according to the type of disease/surgery (statistical analysis was not performed because of the small sample size in some groups): mean pain intensity as measured with NRS was 4.9 ± 2.4 ; patients who underwent knee surgery complained of more severe pain, with patients undergoing replacement showing higher pain intensity scores than those who underwent osteosynthesis.

According to ID Pain, 45.6% of patients complained of probable/likely neuropathic pain (33.8% probable, 11.8%

likely). Patients with knee fixation had a 100% probability of likely neuropathic pain (Table 2).

With regard to the McGill Pain Questionnaire more severe pain was reported by patients who underwent knee replacement and knee fixation, as measured by the PRI. When the three major descriptors (Sensory, Affective, Evaluative) of the McGill Pain Questionnaire were evaluated, the highest Sensory score was found among knee replacement patients, Affective scores were higher among the groups undergoing knee, femoral, and tibial surgery (vs hip surgery), and Evaluative score confirms (as measured by the NRS) the more severe pain in knee fixation (Figure 2).

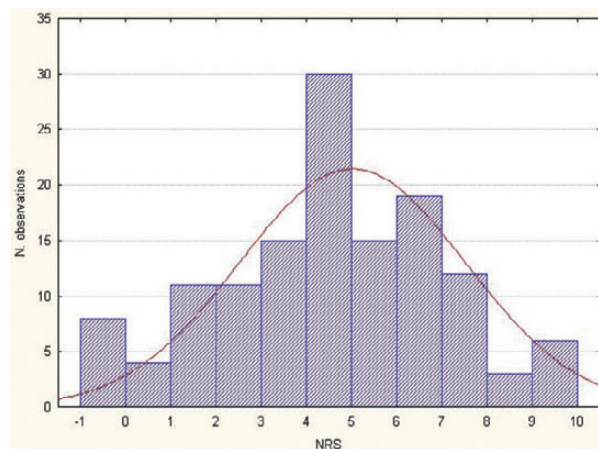


Figure 1 Frequency of numeric rating scale (NRS) results.

Table 2 Pain characteristics according to orthopedic diagnosis

	Age	Surgery (Cases)	McGill [†] Mean (SD)	NRS [*] Mean (SD)	ID Pain (% of Cases with Probable Neuropathic Pain)
Hip (n)	72.1 (12.3)	HR (56)	33.0 (23.7)	4.4 (2.7)	40%
		HF (8)	35.6 (17.8)	4.2 (1.9)	37.5%
Knee (n)	71.8 (8.3)	KR (48)	46.3 (33.3)	5.4 (2.0)	56.3%
		KF (4)	58.9 (6.5)	7.3 (1.1)	100%
Femur (n)	72.7 (12.1)	FF (21)	35.0 (26.2)	5.2 (3.0)	26.3%
Other (ankle, tibia) (n)	66.5 (2.12)	TF (2)	42.6 (31.1)	5.8 (1.1)	50%

* Numeric rating scale: score of 0 represents no pain and a score of 10 represents the worst imaginable pain.

† McGill ranging from 0 (no pain) to 78 (maximum pain score).

HR = hip replacement; HF = hip fixation = osteosynthesis; KR = knee replacement; KF = knee fixation; FF = femoral fixation; SD = standard deviation; TF = tibial fixation.

Table 3 Relationship between numeric rating scale and Short Form 36 Health Status Survey subscores

	Physical Function	Role Physical	Bodily Pain	General Health	Vitality	Social Function	Role Emotional	Mental Health	Physical Composite Score	Mental Composite Score
<i>R</i>	-0.1	-0.3	-0.3	-0.2	-0.3	-0.1	-0.1	-0.1	-0.2	-0.2
<i>P</i> value	0.168	0.004	0.002	0.058	0.004	0.255	0.168	0.103	0.031	0.016

Bold denotes statistically significant results.

No significant associations were found between the various pain measures (severity, through NRS, and type through ID Pain) and gender, age, BMI, and education. The relationship between severity (according to NRS) and kind of pain (according to ID Pain) revealed that the more severe the pain, the higher the probability of suffering from neuropathic pain ($P < 0.001$, $r = 0.4$).

Several QoL subscores correlated with severity of pain, and more severe pain was associated with both lower

physical and mental SF-36 scores (Table 3). In contrast, ID Pain scores did not correlate with SF-36 scores.

Concerning the number of sessions/days in which the patient modified or interrupted rehabilitation on account of pain, in none of the cases did pain cause the modification of the rehabilitation in 1 day only. In all cases, modification occurred at least on two consecutive days, usually more. With regard to the impact of pain on rehabilitation, in 38.6% of patients pain caused the physiotherapist to

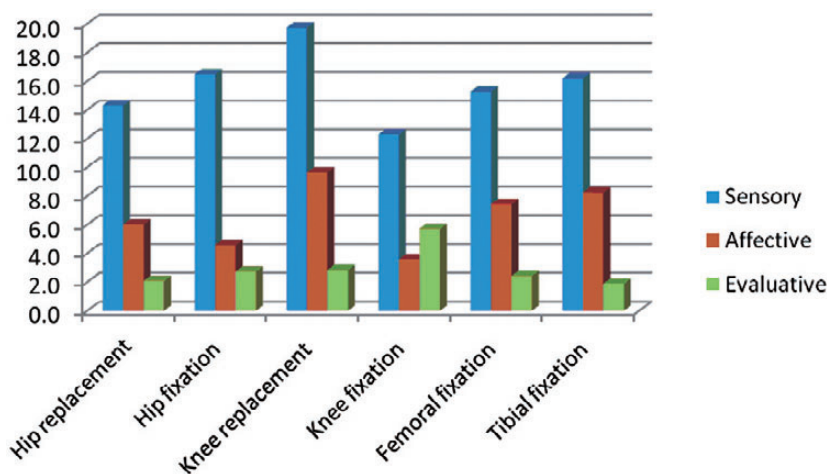


Figure 2 The three major descriptors (Sensory, Affective, Evaluative) of McGill Pain Questionnaire and pain rating index.

modify the rehabilitation program (by decreasing the load or intensity of exercise), while in 18.5% pain led to rehabilitation discontinuation.

Logistic Analysis Results

The only variable with a significant effect on pain-related interruption/modification of the rehabilitation process is NRS. The logit model showed that NRS score increased the probability of interrupting/modifying the rehabilitation program. As the NRS score increased by one unit, the odds of this outcome increased by 1.3 (95% confidence interval: 1.092–1.532).

Discussion

Pain and functional limitation are the main reasons that lead patients to seek orthopedic surgery. The international literature on the clinical course and functional outcome of these patients is extensive [1,23]. The literature on the evaluation and etiologies of pain in these patients is also well developed but, to date, little information has been reported on the type of pain [24,25] experienced by orthopedic surgery patients during rehabilitation and the extent to which pain interferes with the rehabilitation process and negatively affects long-term outcomes [8].

Acute postoperative pain is a well-known complaint of patients undergoing joint replacement [25]. Sometimes pain can last for many months after surgery distressing the patients and reducing their QoL. Iatrogenic neuropathic pain is probably the most common type of postsurgical persistent pain [26].

Wylde et al. reported that persistent postsurgical pain after joint replacement is common, although mild, and/or infrequent, or having shown an improvement compared with preoperative pain [24]. The same author, using the Short Form McGill Pain Questionnaire, found that only 6% of total knee replacement patients and 1% of total hip replacement patients reported neuropathic pain after about 40 months following surgery [24].

Harden et al. found that the prevalence of signs and symptoms consistent with neuropathic pain after total knee arthroplasty was 21.0% 1 month following surgery, 13.0% after 3 months, and 12.7% after 6 months [27].

Buvanendran et al. showed that in patients having undergone total knee replacement, the incidence of neuropathic pain (measured using the Leeds Assessment of Neuropathic Symptoms and Signs pain scale) was 8.7% after 3 months and 5.2% after 6 months [28].

Despite advances in the understanding of the processes that lead to persistent pain and the increasing ease of identification of patients at risk of developing such pain, the management and prevention of postsurgical persistent pain remains inadequate. As the intensity of the

acute postoperative pain correlates with the risk of chronic postsurgical pain [29,30], early successful treatment in the acute phase of the recovery period could help to reduce the risk of developing persistent pain [26].

It is also important to note that refractory acute postsurgery pain is predictive of poor postsurgical rehabilitation outcome [31,32], so a more comprehensive knowledge of pain during the post-acute rehabilitation process could allow us to identify more efficacious strategies to treat it.

To our knowledge, the present study is the first attempt to quantify and characterize post-acute pain in inpatients attending postsurgical orthopedic rehabilitation.

In this preliminary multicenter study, we found that pain occurred frequently in our inpatients undergoing lower limb rehabilitation, and almost half complained of probable/likely neuropathic pain (33.8% probable and 11.8% likely neuropathic pain). This result is not so different from that reported by Harden et al., where 21.0% of study patients were found to have neuropathic pain 1 month after total knee replacement surgery.

The disagreement between our results and the Wyle and Buvanendran's data could be due to different pain outcome measures used and differences in the time from surgery.

We assessed for neuropathic pain using ID Pain, which is a 6-item tool originally developed for screening of primary care patients for NP. ID Pain is not a multidimensional tool; it does not provide metrics for pain intensity nor pain characteristics. As a screening tool, however, the major goals for its development are ease of use, validity and predictive accuracy.

Neuropathic pain in our sample may have a physiopathological explanation. In fact, all our patients who underwent major lower limb orthopedic surgery certainly had some damage to joint nociceptors (located in the joint capsule and ligaments, bone periosteum, articular fat pads, and around blood vessels), and activation of peripheral nociceptors induces changes in central nociceptive pathways (dorsal root ganglia and the spinal cord) as well as behavioral hyperalgesia, as recently shown also in an experimental model of painful osteoarthritis [33]. Moreover, comparative gene expression studies have revealed that the pain pathways involved in painful osteoarthritis (using a rat model) may overlap with neuropathic pain mechanisms [33]. Indeed, our results, if confirmed, would have relevant implications in terms of pharmacological pain management, as neuropathic pain requires specific treatment [34]. As our logit model showed, pain intensity appears to play a crucial role in the rehabilitation program.

As expected, several QoL aspects were related to the severity of pain. In particular, more severe pain (regardless of its nature, nociceptive, or neuropathic) was associated with lower physical and mental SF-36 scores. The interpretation of these findings is limited by the cross-sectional

design of the study, but it is likely that reducing pain intensity, either pharmacologically or by physical therapy or by a multimodal pain approach [35,36] may significantly improve patients' QoL. On the other hand, the association between pain and the mental dimension of QoL suggests that a multidisciplinary rehabilitation approach, including psychological support should be considered, especially in patients affected with chronic musculoskeletal pain [31,37,38].

As to the relationship between pain and the rehabilitation process, the physiotherapists reported that pain interfered with rehabilitation process in more than half of the patients. A limitation of the study is that data concerning pain and interruption/modification of rehabilitation were subjectively detected by the therapist (using an ad hoc form). These data are of course highly subjective, both from patients and physiotherapist perspectives, but pain itself is subjective and no tools are available to objectively evaluate it during rehabilitation process. It is possible that pain has negatively influenced the rehabilitation program, thus increasing the cost of rehabilitation, as suggested by other studies [8]. However, we did not collect information on treatment outcomes or associated costs. Finally, other study limitations include the small number of subjects in some groups (hip and knee fixation) that did not allow to statistically evaluate the results for these surgical subgroups.

Conclusions

Pain had a high occurrence and intensity in this sample of orthopedic inpatients undergoing postsurgical rehabilitation. An unexpectedly, high occurrence of neuropathic pain was observed. Pain interfered with rehabilitation and was associated with decreased QoL, and the more severe pain was neuropathic. If these results are confirmed in subsequent studies, pharmacological therapy focused on neuropathic pain should be strongly considered in the management of these patients in order to improve the compliance with the rehabilitative program and to ameliorate patient outcomes.

Acknowledgments

We would like to thank Chiara Briani (MD) for her editing work.

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