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ORIGINAL ARTICLE

# Metastatic paraplegia: care management characteristics within a rehabilitation center

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**Study design:** Retrospective study.
**Objectives:** To determine the potential impact of rehabilitation care on associated symptoms and functional improvements of paraplegic patients with metastatic spinal cord compression.
**Setting:** CMN Propara, Montpellier (France).
**Measures:** Demographics, Functional Independence Measure (FIM), Frankel Modified Score and Visual Analog Scale (VAS) for pain, intercurrent adverse medical events and neurological outcome, duration of stay, survival time, rehospitalization in a non-Spinal Cord Injury unit, number of contracts defining the patients rehabilitation goals, number of contracts defining the patients duration of stay within the rehabilitation center.
**Results:** We reviewed the charts of 26 patients. The initial neurological profile was paraplegia or paraparesis for 24 patients and quadriparesis for 2 patients. Regarding functional improvements: four patients demonstrated a poor functional evolution, five patients showed no functional improvements or very slight improvements and all the other patients showed an increase in their overall functional aptitudes. At the end of the stay, 14 patients were urinary independent. Our study reports 52 rehospitalizations in an another unit and 101 outpatient visits during their rehabilitation stay in a physical medicine and rehabilitation (PM&R) center. For the 14 patients who were deceased at the time of data collection, the median survival rate post-paraplegia was 12.7 months. A total of 12 of the 14 patients spent more than a third of their remaining survival time in a rehabilitation center.
**Discussion:** Compared to the patients' life expectancy, their stay in a rehabilitation center is too long and prevents them from spending time with family and loved ones. The occurrence rate of the associated symptoms is high because of both cancer-related disorders and neurological disorders caused by the spinal cord lesion. PM&R professionals are faced with patients affected by chronic pain and fatigue as well as frequent rehospitalizations, short stays and outpatient stays, in the primary oncology unit. This study focuses on the need to privilege the patients' comfort over their functional rehabilitation.
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**Keywords:** rehabilitation; spinal cord compression; spinal metastasis; functional outcome

## Introduction

A dearth of relevant literature clearly shows that metastatic paraplegia is a pathology that has been ignored by Physical Medicine and Rehabilitation (PM&R) specialists in the past 30 years.[1–6] Only 10–14% of patients with a spinal epidural metastasis are admitted into a PM&R center.[7] The teams are usually not used to dealing with chronic pain, fatigue and other symptoms related to metastatic paraplegia. However, some articles highlight the positive impact of PM&R care for these patients if a contract is clearly established early on listing the rehabilitation goals and the duration of stay. Consequently, this contract is a determining factor for the high rate of patients being able to return home and avoid a long-term hospitalization after a stay in a PM&R center.[4] Unfortunately most studies focused on prognosis. Taking into account associated symptoms and functional improvements we conducted a retrospective study to determine if the patients' comfort should prevail on the functional improvements or if these two aspects could be efficiently managed by the PM&R teams.

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## Methods

The study reports the experience of four PM&R centers that have treated, in the past 5 years (2003–2007), patients with

spinal metastases. The corresponding author went to all four centers to supervise the data collection. We collected data on: cancer evolution, history of spinal metastasis, neurological and functional impact, pain, urinary disorders, rehabilitation contract, adverse medical events during the stay, average duration of stay and survival rate. Furthermore, we collected data on rehospitalizations, short-stays or outpatient visits in the primary oncology unit whereas the patients were treated in the PM&R center. The pain was assessed using a Visual Analog Scale (VAS). The analgesics listed in our study were classified using the WHO classification.[8] The Functional Independence Measure scale (FIM) is an 18-item, seven level ordinal scale with scores ranging from 1 (total assist) to 7 (complete independence). The patients were classified according to the American Spinal Injury Association (ASIA) standards.[9]

## Results

*Demographics data*

In total, 26 patients, 21 men and 5 women, were included in the study. The mean age upon admission into a rehabilitation center was 57 years (E: 16–82, s.d.: 15).

*Clinical data*

Primary cancer locations were: breast, lung and prostate (Figure 1). In 25 cases, the diagnosis of metastasis was made after the diagnosis of the primary cancer. The time delay for the onset of the first symptoms after a known primary cancer was 21 months (E: 0–101, s.d.: 31 months). The first symptoms of spinal metastasis, in a context of a known primary cancer, were back pain (nine cases), neurological pain (four cases), sudden motor deficit (six cases) or progressive motor deficit (seven cases).

In most cases surgery was the first-line treatment for spinal metastasis (Figure 2).

Regarding the intercurrent adverse medical events that occurred during the patients stay, we collected the ones that required a transfer to another unit or major therapeutic treatment (Table 1). Pain complaints were collected using the VAS. The evolution of the VAS pain score during the patients stay is reported in Figure 3 and classified according to a VAS pain score at 0, less than 5 and more than 5 on a scale of 0–10. We were unable to collect the VAS pain scores for 12 patients at the beginning of their stay and for 9 patients at the end of their stay. If the VAS score collection was not done for these patients, the prescriptions showed, however, that analgesics were administered to 19 patients at the beginning of the stay and 12 patients at the end of the stay (Figure 4). No patients had an intrathecal morphine pump implanted. Seven patients constantly used morphine (class 3) as an analgesic during their entire rehabilitation stay.

Our study reports 52 rehospitalizations in an another unit and 101 outpatient visits during the patients rehabilitation stay in a PM&R center.

*Neurological data*

The topography of the metastasis was thoracic in 22 patients, cervical in 3 patients and thoracocervical in 1 patient.

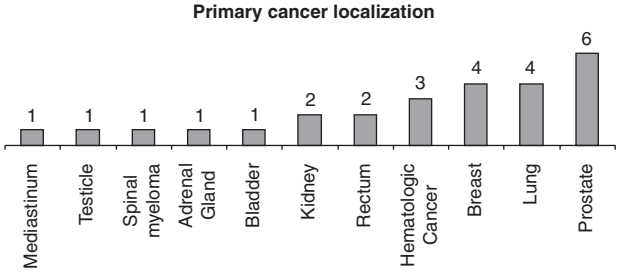


**Figure 1** Primary cancer localization.

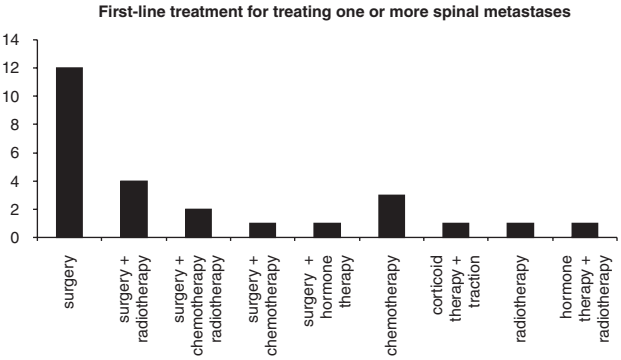


**Figure 2** First-line treatment for treating one or more spinal metastases.

**Table 1** Intercurrent medical events during the first PM&R stay

| *Events* | N |
|---|---|
| Aplasia | 1 |
| Thrombophlebitis | 1 |
| Pressure ulcer | 1 |
| Dermatological disorder | 1 |
| Orthopedics disorder | 1 |
| Hemorrhaging | 2 |
| Psychological disorders | 2 |
| Lung metastasis | 2 |
| Infectious disorders | 3 |
| Cardiac decompensation | 3 |
| Debilitating fatigue | 5 |
| Respiratory decompensation | 5 |

The initial neurological profile was paraplegia or paraparesis for 24 patients and quadriparesis for 2 patients. Upon admission to the PM&R center, 13 patients were ASIA A or B and 11 were ASIA C or D (Figure 5). We did not have any relevant data for two patients. For 10 patients, we reported no changes in their ASIA classification by the end of their first stay and 2 patients progressed from an ASIA B to D.

*Functional data*

For seven patients, a rehabilitation care contract was established. It defined the rehabilitation goals, wheelchair recommendations, independence in daily life activities, abilities to manage their transfers, gait status, bladder and sphincter evaluation and finally pressure ulcer treatment.

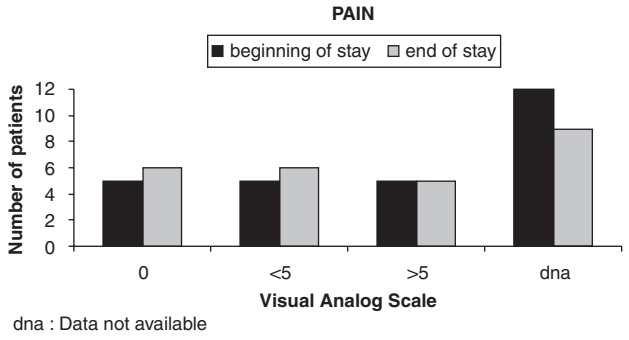


**Figure 3** Pain intensity (Visual Analog Scale, VAS) during the first stay.

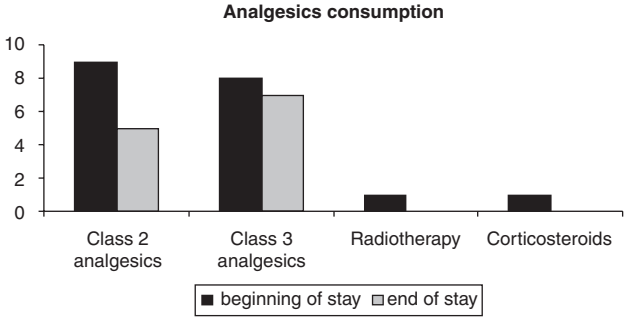


**Figure 4** Analgesics consumption.

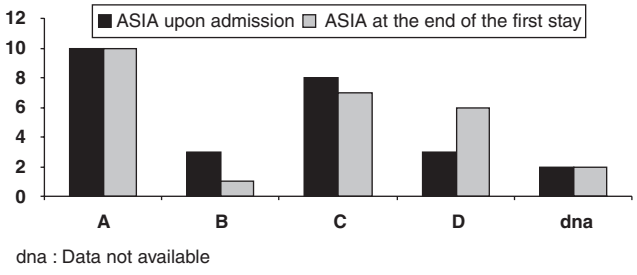


**Figure 5** American Spinal Injury Association (ASIA) classification upon admission and at the end of the first stay.

Four patients had a contract that defined the duration of stay. For three patients, the duration of stay was 30–60 days and for one patient it was 90 days. The average duration of stay in a rehabilitation center after a diagnosis of spinal metastasis was 161 days (E: 8–461, s.d.: 115). Six patients came back for a subsequent stay $<90$ days.

We looked at the progression of the patients' functional status as defined by the differential between FIM scores at the end of the stay and upon admission in the PM&R center. Four patients demonstrated a poor functional evolution, four patients demonstrated no improvements or very slight improvements in their functional abilities (positive differential $<10$ points) and all other patients demonstrated an increase in their overall functional aptitudes (positive differential $>10$ points). As seen in Figure 6, the location of the primary cancer did not seem to have an impact on the functional evolution potential and duration of stay.

The data on urinary independence at the beginning of the stay showed that 12 patients proceeded with intermittent self-catheterization, spontaneous miction without residual, imperious miction requiring a penile sheath, miction triggered by bladder tapping. One patient did not have any urinary incontinence. Seven patients had an indwelling catheter. At the end of the stay, 14 patients were urinary independent: 4 with intermittent self-catheterization, 7 with spontaneous miction, 1 with imperious miction and another 1 with miction triggered by bladder tapping. One patient underwent a urinary Bricker derivation. Seven patients still kept an indwelling catheter.

*Follow-up*

For the 14 patients who were deceased at the time of data collection, the median survival rate post-paraplegia was 12.7 months (E: 3–38, s.d.: 11.2). In Figure 7, duration of hospital stay is benchmarked against the time interval between the onset of their paraplegia and their death. A total of 12 of the 14 patients spent more than a third of their remaining survival time in a rehabilitation center. One patient was lost to follow-up. For the 11 patients who were still alive at the time of data collection, the median survival rate post-paraplegia was 21.1 months (E: 6.5–48, s.d.: 12.1). The ratio 'duration of hospital stay/survival time' is shown in Figure 7.

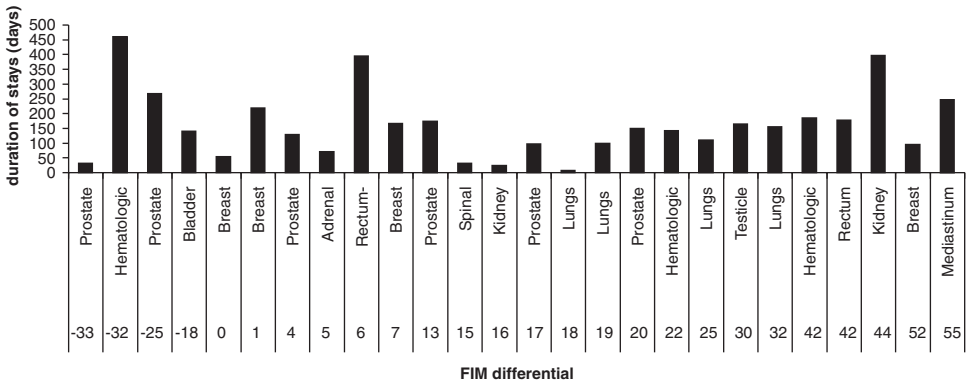


**Figure 6** Evolution of the patients' global independence.

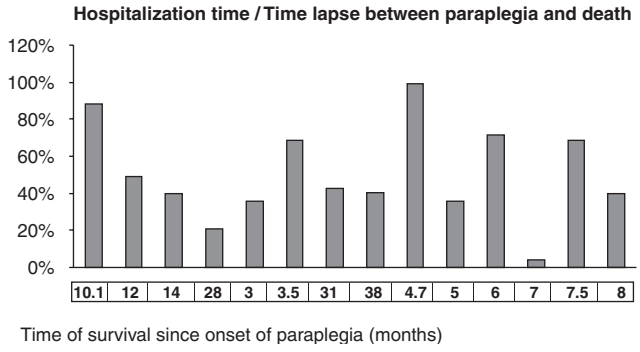


**Figure 7** Ratio between hospitalization time and survival time for patients that were deceased at the time of the review.

Seven patients were transferred to a palliative care unit. One patient was transferred to an intensive care unit where he or she died. No data were available for the four other patients. Finally, 14 of the 26 patients (53%) were able to return home.

## Discussion

Not much information is available on PM&R care for patients with metastatic paraplegia. Our study underlines the need for standardized admission criteria and rehabilitation care contracts defining the rehabilitation goals and duration of stay. This contract is very useful in providing the patients with realistic rehabilitation goals and potential functional outcomes.

*Associated symptoms*

Besides the side effects triggered by anticancer therapeutics, the symptoms associated to metastatic paraplegia do not seem to differ from those associated to trauma spinal cord injury (SCI). It is more the context surrounding these associated symptoms that differs from classic SCI patient care.

The symptoms can be common to trauma SCI but aggravated by cancer (primary cancer and spinal metastasis): back pain or neuropathic pain, transit disorders, static disorders of the spine, upper and lower respiratory tract infections and skin disorders. The symptoms can also be cancer related: appetite disorders, fatigue, psychological disorders, adverse effects of first-line treatments. The McKinley prospective study reports urinary tract infections (UTIs) for 14 patients, respiratory tract complications for 6 patients and other symptoms for 6 other patients: pressure ulcers, gastroparesis, intestinal obstruction, nervous breakdown, hyponatremia and neutropenia.[4]

*Pain*. For the patients in our study the pain was constant from the beginning to the end of their rehabilitation stay. We collected data on the intensity of their pain or on the amount of analgesics prescribed. We reported pain as the most frequent first symptom (more than half of the patients). The Helweg-Larsen study reports that 88% of their 153 patients demonstrated pain at the time of the spinal metastasis diagnosis when the locomotor disorders appeared.[10] Pain can be a telltale sign of spinal metastasis sometimes several months before the first neurological symptoms, median time interval being 40 days.[10] This elapsed time between the onset of pain, and the diagnosis of spinal metastasis has a damaging psychological impact on the patients by reminding them that specialists took a long time to correlate their pain to a spinal metastasis, especially before the onset of the first neurological symptoms.

In the McKinley study patients demonstrated at first a fluctuating pain that rapidly became persistent[4] once the neurological disorders had set in. The pain can be caused by existing lesions (bone destruction, vertebral instability, spinal cord compression, SCC) or sometimes by recurrent or extensive lesions or even spinal nerve root compression (SNRC), in all cases this pain alters considerably the quality of life of these patients and impairs the assessment of their potential functional progresses. The nighttime recrudescence of the pain is shown to be a warning sign of metastatic relapse.[11] In a large cohort of 398 patients, Bach *et al*.[12] estimated at 83% the percentage of patients suffering from SCC pain before the onset of the first neurological symptoms. After that the pain is classified into SCC pain (36%) and SNRC pain (47%).

The pain can be spontaneous but also triggered by the rehabilitation exercises provided by the PM&R teams and thus be a major obstacle to the patients functional progresses. Therefore our study demonstrates the need for PM&R teams to elaborate a specific rehabilitation program for patients with metastatic paraplegia different from the one designed for trauma SCI patients. To alleviate back pain, opioids as well as steroidal and nonsteroidal anti-inflammatory drugs are limited by their classic adverse effects (transit disorders, sleepiness…)[13] but are still largely prescribed. In the Guo cohort, 93% of patients were taking opioid drugs at the end of their rehabilitation stay.[6] For SNRC pain neuropathic analgesics are efficient but limited due to their potential adverse hematological reactions.[14] The validated efficacy of the $\gamma$-aminobutyric acid analogs should overcome this limitation.

Morphine is the best option for cancer pain because of its low or lack of toxicity on the organs. Transdermic patches are even better—less impact on transit functions.[13] The initial high-dose corticosteroids prescribed to limit the spinal cord edema,[15] should be progressively decreased to moderate-term, low-dose corticosteroids to ensure the necessary additional pain relief.[15]

*Transit disorders*. Constipation affected all the patients in our study yet this topic is not often addressed in the literature. The management of these transit disorders differs from classic trauma SCI care. For spinal metastasis patients with incomplete paraplegia the efforts produced during a bowel movement (Valsalva maneuver) trigger neuropathic and back pain. Furthermore for these patients who combine potential undernutrition, the adverse effects of opioids and neuropathic analgesics, immobility and vegetative dysfunctions, and constipation should be avoided at all costs.

*Urological disorders*. These symptoms rarely come first. In fact, they appear alongside the locomotor disorders, 50% of patients have to empty their retentive bladder by indwelling catheterization, intermittent catheterization or self-catheterization. The sole fact that 14 patients kept their urinary independence at the end of their rehabilitation stay shows the positive impact of the training and educational teachings provided by the PM&R staff. Seven patients regained a spontaneous miction and seven others kept a catheter. For some patients with an altered general state, a well-managed indwelling catheter, might be a better solution than problematic self-catheterizations.

*Static disorders of the spinal cord*. Some patients might benefit from wearing a chest harness to prevent an aggravation of their spinal kyphosis, limit the deformation of the spinal cord, mainly at the junction areas and reduce the intensity of their pain. For some authors this chest harness should not be kept for more than 6 to 10 weeks.[16] In regards to the duration of stay in the rehabilitation center and the rehabilitation objectives set, this already seems too long.

*Appetite disorders*. Mostly they are linked to the primary tumor rather than the spinal metastasis.[17] The PM&R staff should not overlook the negative impact of anticancer drugs on the patient's appetite. The literature reports an alteration of the patients' general state and their skin as well as their aptitude to go on with therapy without a proper food intake. The undernutrition is reflected in the albumin levels: for 62% of the patients of the Guo cohort, the levels are below 3.5 g per 100 ml.[6] Resorting to a gastrostomy feeding tube should mark the end of the patients stay in a PM&R unit, they should be transferred to a palliative care unit.

*Fatigue*. We should discard any metabolic disorders and run some blood tests (anemia, leukopenia) before incriminating any other etiology. A third of the patients from the Guo demonstrated hemoglobin levels $<10$ g per 100 ml but their anemia did not interfere with their survival prognosis.[6] Conversely, Huddart[18] demonstrated that hemoglobin levels $>12$ g per 100 ml were a good predictive factor for survival. This fatigue is also due to anticancer therapeutics and undernutrition and is the result of various associated symptoms. The PM&R teams have to take this fatigue into account when establishing the patients' rehabilitation care contract because of its potential impact on their decision to go on with their rehabilitation program.

*Psychological impact*. The patients are aware of the severity of their cancer but at the same time they tend to undermine the seriousness of their functional prognosis.[17] They are afraid of being hospitalized, they have to deal with the suffering of their family and loved ones as well as their fear and anxiety of rupture and death.

Metastatic recurrence is a constant threat but in reality only observed in 8 to 20% of the patients according to the cohorts[19,20] with an average onset time of 7 months after the initial diagnosis. The initial spinal location is identified in 55% of cases and another location is discovered in 45% of cases. The recurrence risk is correlated to the survival rate: 50% of survivors at $+2$ years and almost all survivors at $+3$ years develop a recurrence. However, for initial multifocal spinal metastasis, the recurrence risk is not statistically more important (7.1% for one location, 8.1% if there is more than one location).[21]

The necessary psychological counseling must focus on offering different solutions to the patients and their family through individual therapy, support groups and behavioral techniques.

*Adverse side effects for first-line treatments*. Corticosteroids are useful in the acute phase of the neurological lesion and for their pain-relief action. This universal consensus is backed up by a high level of proof,[22] yet no agreement was reached on the maximum dosage and treatment duration versus toxicity. Sorensen *et al*.[15], in a randomized study (radiotherapy and high dosage of dexamethasone versus radiotherapy alone) reported a significant gait improvement ($P=0.046$) in 57 patients (SCC) taking corticosteroids. However, the study reported a high level of adverse effects and three patients demonstrated serious ones such as a severe psychosis, gastric perforation and ulcer. The long-term impact of corticosteroids on neurological improvement is still being debated.[23] Furthermore, for the post-surgical phase, no data are available on a potential infectious risk linked to the use of corticosteroids.

Radiotherapy has a low morbidity rate. Its pain-relief impact has been demonstrated in 80–90% of patients.[24] The side effects of this therapeutic are mainly fatigue and nausea, sometimes digestive disorders when the digestive tract is irradiated.

Chemotherapy is usually used for treating the primary cancer and not the local spinal metastasis. However, PM&R teams must be aware of the potential side effects of the patients chemotherapy protocol and redefine, if necessary, the limits of the rehabilitation care for these patients.

Surgery does not trigger any morbidity besides the major septic risk of a surgical wound in a context of associated radiotherapy, undernutrition and skin weakness. Wound complications (32%) were observed when radiotherapy took place before surgery compared with 12% if surgery was the first-line treatment ($P<0.05$).[25]

*Rehabilitation care contract*

When life expectancy conditions the PM&R care, the contract defines right away the limits of the patients rehabilitation stay. This contract goes beyond the patients' sole judgments and wishes even though their needs and expectations are taken into account. The objectives of the rehabilitation care must be weighed against the emotional and physical loads the family can manage. This contract will also take into account the advice from neurosurgeons and oncologists and the associated symptoms. The goal of this contract is to define the right balance between time left to spend with family and loved ones and time spent on rehabilitation training. A prospective study on the func-

**Table 2** Karnofsky performance status scale

| | | |
|---|---|---|
| Able to carry on normal activity and to work; no special care needed. | 100 | Normal no complaints; no evidence of disease. |
| | 90 | Able to carry on normal activity; minor signs or symptoms of disease. |
| | 80 | Normal activity with effort; some signs or symptoms of disease. |
| Unable to work; able to live at home and care for most personal needs; varying amount of assistance needed. | 70 | Cares for self; unable to carry on normal activity or to do active work. |
| | 60 | Requires occasional assistance, but is able to care for most of his personal needs. |
| | 50 | Requires considerable assistance and frequent medical care. |
| Unable to care for self; requires equivalent of institutional or hospital care; disease may be progressing rapidly. | 40 | Disabled; requires special care and assistance. |
| | 30 | Severely disabled; hospital admission is indicated although death not imminent. |
| | 20 | Very sick; hospital admission necessary; active supportive treatment necessary. |
| | 10 | Moribund; fatal processes progressing rapidly. |
| | 0 | Dead |

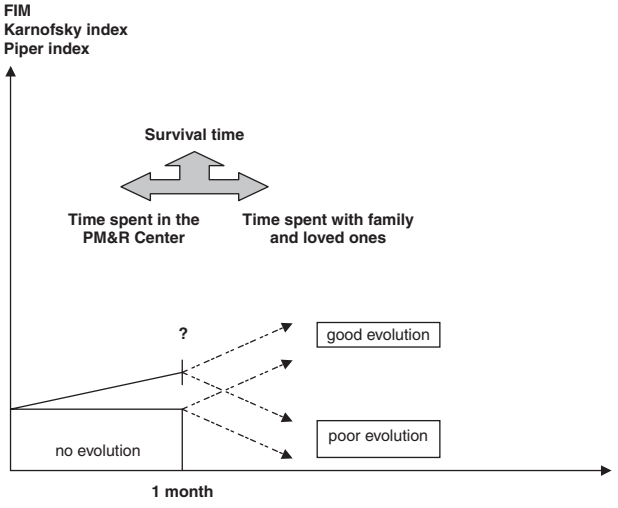


**Figure 8** Metastatic paraplegia evolution follow-up.

tional outcome of 32 patients over 5 years, suggested that the functional status or functional improvements can last up to 3 months after leaving the rehabilitation center.[4] It showed that the functional improvements and the progression rate are identical for metastatic patients and trauma SCI patients in the first 3 months. We are probably faced with a selection bias since the patients were included based on a vital prognosis > 3 months and an aptitude to undergo at least 3 h of rehabilitation training per day. A literature analysis led us to assess the evolution rate using the Karnofsky performance status scale (KPSS)[26] (Table 2), a so-called Piper fatigue scale[27,28] and the FIM.[29] The correlation between the FIM and the KPSS is linear.[30] When the KPSS is lower or equal to 40 for a non-walking patient with spinal metastasis on a lung neoplasm, Abrahm[16] estimated the survival rate at 4.4 months in average limiting the perspectives of rehabilitation care. This underlines the relevance of drawing the evolution curve according to three criteria—the FIM, the KPSS and the Piper index—and to determine beyond the first month the balance: survival time/PM&R care/time left with family and loved ones (Figure 8). The contract defined in the first month (Table 3) was partly based on the cancer rehabilitation care principles described by Gamble *et al*.[17] and by O'Toole *et al*.[30] The basis of this contract are: early admission into a SCI Unit, explicit care contract, taking fatigue into account, clearly identifying the role of each PM&R professional, involving the patients and their family in all decisions. We need to be pragmatic in our therapeutic choices.

**Table 3** Rehabilitation care contract

| *During the first month* | *Beyond the first month* |
|---|---|
| 1. Wheelchair adaptation<br>2. Bladder management rehabilitation<br>3. Restoring the general state<br>4. Educational training for the caregivers on transfers<br>5. Adapting the pain-relief treatment<br>6. Psychological counseling management<br>7. Improving the nutritional status<br>8. Exploring the patient's financial aids | In addition to the above<br>1. Transfer training<br>2. Independence training for daily life activities<br>3. Adapted housing |

Beyond the first month, based on the patients' status, new rehabilitation training aspects can be added to the original contract (Table 3).

## Conclusion

Thanks to the recent therapeutic advances for treating primary cancer, patients are living longer. There is a suggested higher incidence of lung, prostate and breast cancers,[31] leading to complications such as metastatic SCC. In this epidemiological context PM&R teams will be treating more and more patients with metastatic paraplegia in the future. Most patients demonstrate some functional improvements and our literature review underlines the need for a compromise between the time spent in a PM&R center and the time left to spend with family and loved ones. The key to a successful rehabilitation program is the patient's active participation, PM&R teams can achieve that by setting up

reasonable rehabilitation goals, taking the patients' associated symptoms into consideration and privileging their comfort. However, to this day, no study can demonstrate the impact of rehabilitation in controlling the morbidity and increasing the patients' life expectancy.

Even though we are aware of the main limits of a retrospective study: incomplete patient charts, memory bias, missing data and study selection bias. The aim of this retrospective study was really to set up a rationale for a controlled prospective study based on the same reading tool.

## Acknowledgements

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## References

1 Eriks IE, Angenot EL, Lankhorst GJ. Epidural metastatic spinal cord compression: functional outcome and survival after inpatient rehabilitation. *Spinal Cord* 2004; **42**: 235–239.
2 Hacking HG, Van As HH, Lankhorst GJ. Factors related to the outcome of inpatient rehabilitation in patients with neoplastic epidural spinal cord compression. *Paraplegia* 1993; **31**: 367–374.
3 Murray PK. Functional outcome and survival in spinal cord injury secondary to neoplasia. *Cancer* 1985; **55**: 197–201.
4 McKinley WO, Conti-Wyneken AR, Vokac CW, Cifu DX. Rehabilitative functional outcome of patients with neoplastic spinal cord compressions. *Arch Phys Med Rehabil* 1996; **77**: 892–895.
5 McKinley WO, Huang ME, Brunsvold KT. Neoplastic versus traumatic spinal cord injury: an outcome comparison after inpatient rehabilitation. *Arch Phys Med Rehabil* 1999; **80**: 1253–1257.
6 Guo Y, Young B, Palmer JL, Mun Y, Bruera E. Prognostic factors for survival in metastatic spinal cord compression: a retrospective study in a rehabilitation setting. *Am J Phys Med Rehabil* 2003; **82**: 665–668.
7 McKinley WO, Seel RT, Hardman JT. Nontraumatic spinal cord injury: incidence, epidemiology, and functional outcome. *Arch Phys Med Rehabil* 1999; **80**: 619–623.
8 WHO. *Traitement de la Douleur Cancéreuse*. WHO (OMS), WHO Press: Geneva, Switzerland, 1997.
9 Marino RJ, Barros T, Biering-Sorensen F, Burns SP, Donovan WH *et al*. International standards for neurological classification of spinal cord injury. *J Spinal Cord Med* 2003; **26** (Suppl 1): S50–S56.
10 Helweg-Larsen S, Sorensen PS. Symptoms and signs in metastatic spinal cord compression: a study of progression from first symptom until diagnosis in 153 patients. *Eur J Cancer* 1994; **30A**: 396–398.
11 Kienstra GE, Terwee CB, Dekker FW, Canta LR, Borstlap AC *et al*. Prediction of spinal epidural metastases. *Arch Neurol* 2000; **57**: 690–695.
12 Bach F, Larsen BH, Rohde K, Borgesen SE, Gjerris F *et al*. Metastatic spinal cord compression. Occurrence, symptoms, clinical presentations and prognosis in 398 patients with spinal cord compression. *Acta Neurochir (Wien)* 1990; **107**: 37–43.
13 Vrionis FD, Small J. Surgical management of metastatic spinal neoplasms. *Neurosurg Focus* 2003; **15**: E12.
14 Spinazze S, Caraceni A, Schrijvers D. Epidural spinal cord compression. *Crit Rev Oncol Hematol* 2005; **56**: 397–406.
15 Sorensen S, Helweg-Larsen S, Mouridsen H, Hansen HH. Effect of high-dose dexamethasone in carcinomatous metastatic spinal cord compression treated with radiotherapy: a randomised trial. *Eur J Cancer* 1994; **30A**: 22–27.
16 Abrahm JL. Assessment and treatment of patients with malignant spinal cord compression. *J Support Oncol* 2004; **2**: 377–388, 391; discussion 391–373, 398, 401.
17 Gamble GL, Brown PS, Kinney CL, Maloney FP. Cardiovascular, pulmonary, and cancer rehabilitation. 4. Cancer rehabilitation: principles and psychosocial aspects. *Arch Phys Med Rehabil* 1990; **71** (4-S): S244–S247.
18 Huddart RA, Rajan B, Law M, Meyer L, Dearnaley DP. Spinal cord compression in prostate cancer: treatment outcome and prognostic factors. *Radiother Oncol* 1997; **44**: 229–236.
19 Chamberlain MC, Kormanik PA. Epidural spinal cord compression: a single institution's retrospective experience. *Neuro-oncol* 1999; **1**: 120–123.
20 van der Sande JJ, Boogerd W, Kroger R, Kappelle AC. Recurrent spinal epidural metastases: a prospective study with a complete follow up. *J Neurol Neurosurg Psychiatry* 1999; **66**: 623–627.
21 Helweg-Larsen S. Clinical outcome in metastatic spinal cord compression. A prospective study of 153 patients. *Acta Neurol Scand* 1996; **94**: 269–275.
22 Klimo Jr P, Kestle JR, Schmidt MH. Treatment of metastatic spinal epidural disease: a review of the literature. *Neurosurg Focus* 2003; **15**: E1.
23 Gale J, Mead GM, Simmonds PD. Management of spinal cord and cauda equina compression secondary to epidural metastatic disease in adults with malignant germ cell tumours. *Clin Oncol (R Coll Radiol)* 2002; **14**: 481–490.
24 Tong D, Gillick L, Hendrickson FR. The palliation of symptomatic osseous metastases: final results of the Study by the Radiation Therapy Oncology Group. *Cancer* 1982; **50**: 893–899.
25 Ghogawala Z, Mansfield FL, Borges LF. Spinal radiation before surgical decompression adversely affects outcomes of surgery for symptomatic metastatic spinal cord compression. *Spine* 2001; **26**: 818–824.
26 Mor V, Laliberte L, Morris JN, Wiemann M. The Karnofsky performance status scale. An examination of its reliability and validity in a research setting. *Cancer* 1984; **53**: 2002–2007.
27 Piper BF, Dibble SL, Dodd MJ, Weiss MC, Slaughter RE *et al*. The revised piper fatigue scale: psychometric evaluation in women with breast cancer. *Oncol Nurs Forum* 1998; **25**: 677–684.
28 Dittner AJ, Wessely SC, Brown RG. The assessment of fatigue: a practical guide for clinicians and researchers. *J Psychosom Res* 2004; **56**: 157–170.
29 Granger CV, Hamilton BB, Linacre JM, Heinemann AW, Wright BD. Performance profiles of the functional independence measure. *Am J Phys Med Rehabil* 1993; **72**: 84–89.
30 O'Toole DM, Golden AM. Evaluating cancer patients for rehabilitation potential. *West J Med* 1991; **155**: 384–387.
31 Cowap J, Hardy JR, A'Hern R. Outcome of malignant spinal cord compression at a cancer center: implications for palliative care services. *J Pain Symptom Manage* 2000; **19**: 257–264.