Pain management following new and long-standing spinal cord injury: a pilot study of changes in pain intensity experienced during the day

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The aim of the study was to examine variations in pain intensity during the day experienced by patients with spinal cord injury. Fourteen consecutive patients had clinical and demographic data recorded. Pain intensity was recorded using a Graphic Rating Scale (GRS) at 2–3 h intervals. Patients were grouped according to maximum GRS into mild and severe groups at assessment (T0). Changes of one-third in GRS were deemed clinically significant. Eight men and six women (mean age 53.1; SD 16.5; range 28–75) were studied. Seven patients with mild pain tended to deteriorate and those with severe pain to improve. Eight patients demonstrated clinically significant changes. These findings suggest inadequate pain control early morning for one group and increasing pain during the day for another. Use of such simple scores over time would enhance pain rehabilitation for all spinal cord injury patients. Usual GRS reporting may mask clinically significant, treatable, changes in pain. *International Journal of Rehabilitation Research* 00:000–000 © 2013 Wolters Kluwer Health | Lippincott Williams & Wilkins.

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Introduction

Pain after spinal cord injury (SCI) is common, chronic, interferes with function, is resistant to treatment and contributes to a reduced quality of life (Widerstrom-Noga *et al.*, 2009; Kennedy *et al.*, 2010; Heutink *et al.*, 2011). Pain remains a major clinical issue for healthcare professionals advising those with SCIs.

A wide range of assessment tools exist to measure pain, but few are specifically developed for an SCI population or measure change in pain during daytime. Changes of pain during different times of day were recorded in patients with severe physical disabilities in a pilot study of powered wheelchairs users (Gibson and Frank, 2005). Other studies have assessed changes in Graphic Rating Scale (GRS) scores through medication, but research in different pain conditions has been suggested (Jensen *et al.*, 2003). Changes in neuropathic pain at day and night following SCI were investigated and showed significant variations of pain, but their clinical significance was not assessed (Celik *et al.*, 2012).

The objective of this pilot study was to elicit whether pain intensity varied during the day in a cohort of individuals with SCI.

Methods

Sixteen individuals consecutively admitted to an SCI unit between July and October 2010 were asked to participate in a study to assess their pain experience during 1 day. Participants experienced an SCI, were aged 20 years or greater, experiencing pain during hospitalization. Two not experiencing pain were excluded; 14 agreed to participate. At initial interview (time zero – T0), written informed consent was obtained.

The following data were recorded on a purpose-designed proforma at T0:

(1) Demographic: date of birth, age, sex.
(2) Clinical: level of lesion, American Spinal Injury Association Impairment Scale (AIS) grade.
(3) Time since injury.
(4) First admission or readmission for rehabilitation.

Pain assessment

The following were collected at T0:

(1) Pain site(s) – derived by asking patients if they experienced pain in the following areas: spine (cervical, thoracic, lumbar); arms and hands; legs and feet.
(2) Pain intensity: assessed using GRS from 0 to 90 anchored by 'no pain' and 'worst pain you can imagine'. Patients indicated on an identical GRS pain levels for the above sites of pain. The highest GRS from any site at T0 was documented and

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described as follows: 0, no pain; 1–44, mild pain; 45–74, moderate pain; 75–90, severe pain (Jensen, *et al.*, 2003). For this analysis the moderate and severe patients were grouped into the 'severe group', and the no pain to mild into a 'mild group'.

T0 was usually about 08.30 h and three further GRS measurements (T1, T2, T3) were recorded at ~2–3 h intervals over a period of 1 day. Patients were unable to see their previous GRS and scored the current level of pain intensity at all pain sites. The measurements took ~20 min.

Clinically significant changes in pain

Patients whose GRS was 33 or less were deemed not to experience clinically significant changes. Those reporting a GRS of 34 or more were deemed to have a clinically significant change in their pain if the relative difference between the maximum and minimum scores was 33% or more (Jensen, *et al.*, 2003; Grilo *et al.* 2007).

The study was approved by North London 1 Research Ethics Committee.

Results

Participants

Eight men and six women (mean age 53.1; SD 16.5; range 28–75) participated (Table 1). Ten patients were admitted for initial rehabilitation (new patients) and were assessed a mean of 3.6 (range 0.9–7) months following SCI. Four were follow-up admissions, assessed a mean of 150 (range 10–336) months following SCI. Nine lesions were complete, five incomplete.

The 10 new admissions were aged 56.9 (range 28–75; SD 16.7) years and were older than the four follow-up admissions aged 43.5 (range 32–61; SD 13.4) years.

Severity of pain

All patients experienced pain during the study; pain intensity from T0 to T3 ranged between 0 and 90. At T0, the mean maximum GRS was 48.0 (SD 36.9). Six reported severe pain (mean 84.2; SD 5.46; range 78–90). One had moderate pain (GRS = 67); four reported mild pain (mean 24.9; SD 10.6; range 11–33) and three were pain free.

The mean maximum GRS averaged across T0–T3 was 45.7 (SD 6.5; range 40.5–54); for the 10 new patients was 52.5 (SD 24; range 10–80) and the four follow-ups was 70.0 (SD 18; range 50–90). Six had severe pain at some time between T0 and T3; five had moderate and three mild pain (Fig. 1a and b).

Nine patients, with both complete and incomplete lesions, demonstrated clinically significant changes in pain over T0–T3.

Sites of pain

Sites of pain reported by questionnaire were: arms/shoulders ($n = 8$), neck ($n = 7$), hands ($n = 6$), back ($n = 5$) and legs/buttocks ($n = 2$). All eight patients with cervical lesions experienced neck or upper limb pain. Five of the six with thoracic lesions had neck/upper limb pain. Two with back/leg pain had cervical lesions. Neck/arm pains were experienced by 13 of 14 reporting pain. Five in the mild group experienced no low back or leg pain between T0 and T3.

Figure 2 illustrates for one patient (P1) the wide variation in pain experience for different body sites with clinically significant improvements and deteriorations over time.

Discussion

This is the first study, to our knowledge, to show clinically significant changes in SCI pain during daytime. In contrast to previous reports (Gibson and Frank, 2005; Celik, *et al.*, 2012) a proportion in this study

Table 1 Study participants

Patient number	Age	Sex	Diagnosis	Level of injury (AIS Grade)	Range GRS	Months since injury	Initial repeat[a]
P1	63	F	Vascular SCI	C1-4 AIS A	0–78	3	1
P2	70	F	Traumatic SCI	C5-8 AIS D	0–83	1	1
P3	41	M	Traumatic SCI	C1-4 C	0–89	5	1
P4	69	M	Epidural abscess	C1-4 C	0–22	7	1
P5	28	M	Traumatic SCI	T1-S5 A	0–67	2	1
P6	61	M	Traumatic SCI	T1-S5 A	0–55	336	2
P7	46	F	Disc prolapse	T1-S5 A	0–33	5	1
P8	32	M	Spinal neurofibroma	C5-8 D	0–67	22	2
P9	75	M	Traumatic SCI	C1-4 D	0–67	1	1
P10	39	M	Traumatic SCI	C5-8 A	0–55	6	1
P11	66	F	Traumatic SCI	C5-8 A	0–11	1	1
P12	72	F	Epidural abscess	T1-S5 A	0–78	5	1
P13	47	F	Traumatic SCI	T1-S5 A	0–90	233	2
P14	34	M	Traumatic SCI	T1-S5 A	0–89	10	2

AIS, Association Impairment Scale; GRS, Graphic Rating Scale; SCI, spinal cord injury.
[a]1, initial admission; 2, repeat admission.

showed clinically significant improvements and the intensity of pain varied by site during the day.

Pain improvement and aggravation may reflect task performance, inadequate medication before an activity, or could be helped by sustained release analgesia, although many patients have problematic side effects precluding increased analgesia (Hama and Sagen, 2012). Psychosocial pressures following an SCI could also influence the pain experience (Jensen *et al.*, 2011;Kratz *et al.*, 2013). The high levels of pain noted at T0 may reflect the static posture many have to adopt at night, insufficient turning times, suboptimal equipment and inadequate analgesia.

For those with deteriorating pain during the day, the following could be considered: timing of morning medication, self-medication before performing painful activities (Frank and Glossop, 1989), or bladder/bowel management, and modification of daily living activities.

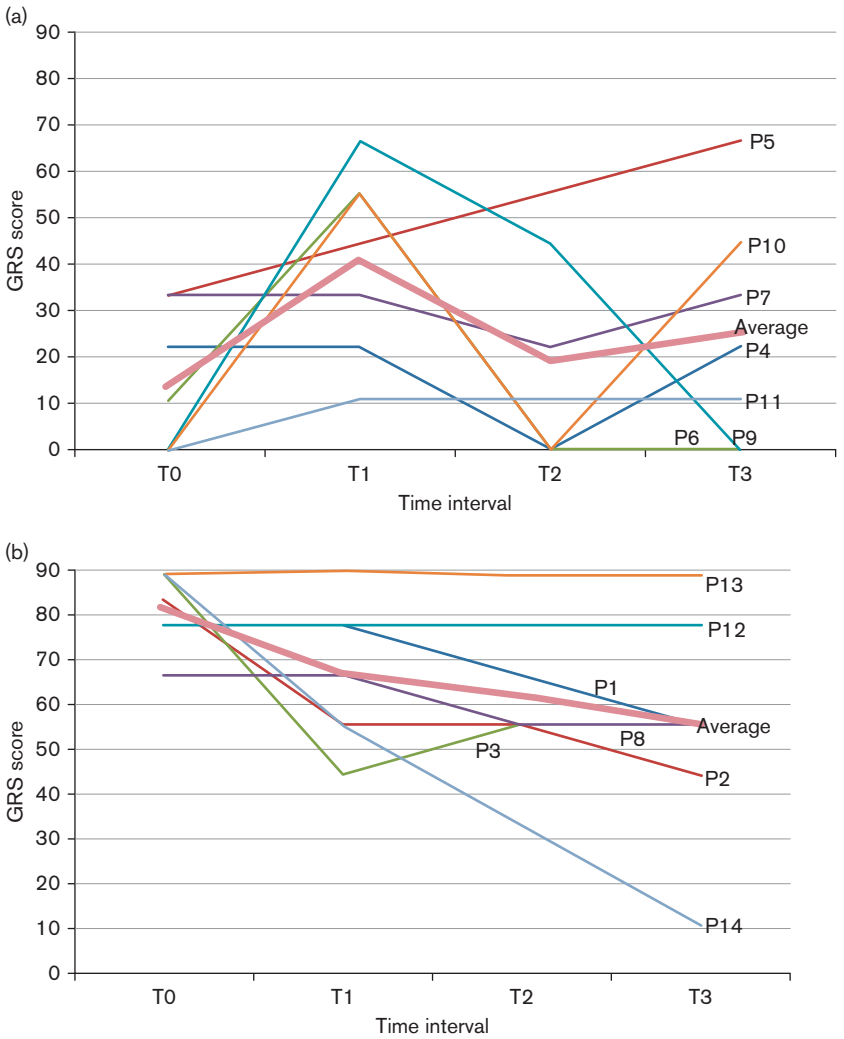
Limitations of the study

Our small sample lacked those with lumbar spine lesions (Celik *et al.*, 2012). Use of the GRS has limitations (Kersten *et al.*, 2010), but remains widely used in clinical and research practice. Recordings were only made during 1 day.

Conclusion

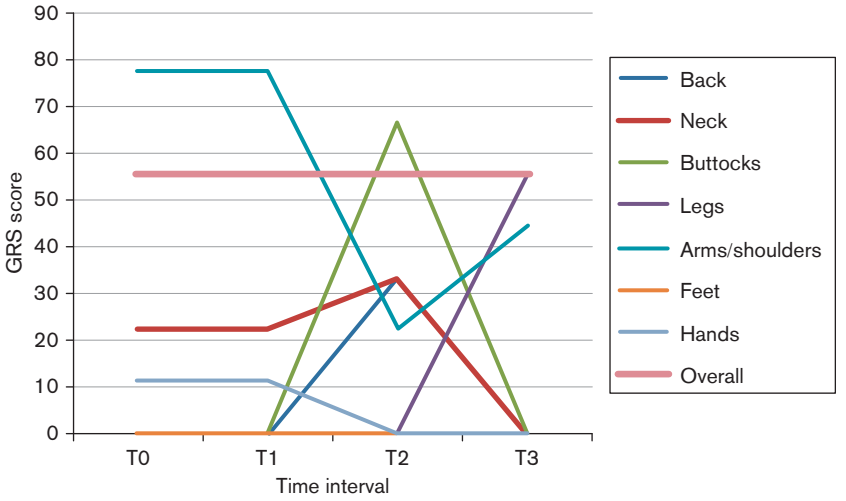
GRS use to assess pain over a previous period of time [e.g. 24 h or 1 week (Kratz *et al.*, 2013)] may mask clinically significant swings of pain. The repeated use of a simple GRS during the day should become a routine tool in the assessment of patients' pain following SCI.

Fig. 1



(a) Maximum GRS over time for 'mild group'. (b) Maximum GRS over time for 'severe group'. GRS, Graphic Rating Scale.

Fig. 2



Illustrative GRS over time for different pain sites (P1). GRS, Graphic Rating Scale.

Our findings suggest avenues for therapeutic intervention by alteration of tasks, lifestyle or through medication.

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Conflicts of interest

There are no conflicts of interest.

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