Available online at www.sciencedirect.com

ScienceDirect

Neuromuscular Disorders 25 (2015) 212–215

www.elsevier.com/locate/nmd

Upper limb module in non-ambulant patients with spinal muscular atrophy: 12 month changes

Serena Sivo [a,1], Elena Mazzone [a,1], Laura Antonaci [b], Roberto De Sanctis [a], Lavinia Fanelli [a], Concetta Palermo [a], Jacqueline Montes [c], Marika Pane [a], Eugenio Mercuri [a,*]

[a] *Paediatric Neurology Unit, Catholic University, Rome, Italy*
[b] *Department of Paediatrics, Child Neurology and Psychiatry, Sapienza University, Rome, Italy*
[c] *Department of Neurology, Columbia University, New York, NY, United States*

Received 10 August 2014; received in revised form 14 November 2014; accepted 18 November 2014

Abstract

Recent studies have suggested that in non-ambulant patients affected by spinal muscular atrophy the Upper Limb Module can increase the range of activities assessed by the Hammersmith Functional Motor Scale Expanded. The aim of this study was to establish 12-month changes in the Upper Limb Module in a cohort of non-ambulant spinal muscular atrophy patients and their correlation with changes on the Hammersmith Functional Motor Scale Expanded. The Upper Limb Module scores ranged between 0 and 17 (mean 10.23, SD 4.81) at baseline and between 1 and 17 at 12 months (mean 10.27, SD 4.74). The Hammersmith Functional Motor Scale Expanded scores ranged between 0 and 34 (mean 12.43, SD 9.13) at baseline and between 0 and 34 at 12 months (mean 12.08, SD 9.21). The correlation betweeen the two scales was 0.65 at baseline and 0.72 on the 12 month changes. Our results confirm that the Upper Limb Module can capture functional changes in non-ambulant spinal muscular atrophy patients not otherwise captured by the other scale and that the combination of the two measures allows to capture changes in different subgroups of patients in whom baseline scores and functional changes may be influenced by several variables such as age.

Keywords: Spinal muscular atrophy; Outcome measure; Hammersmith; Upper limb

1. Introduction

Spinal muscular atrophy (SMA) is a neuromuscular disease characterized by degeneration of alpha motor neurons in the spinal cord. The recent advent of clinical trials has highlighted the need for identifying methods of assessments to be used as outcome measures and to collect natural history data [1–3]. The Hammersmith Functional Motor Scale (HFMS) [4], in its original version or in the subsequent expanded (HFMSE) [5,6] or extended version [7,8], are validated tools widely used in both natural history studies and in clinical trials in SMA [7–16]. A recent study using Rasch analysis in nine of the commonly used measures, including HFMS and Motor Function Measure Scale (MFM) [17] however, has suggested that, even if each of these scales had good reliability, there were several issues impacting scale validity, including the extent that items defined clinically meaningful constructs and how well each scale measured performance across the SMA spectrum [18].

Another recent study using both MFM (in the 20 item version validated before the age of 7 years) [11] and HFMS confirmed some of the limitations of both scales [19]. Both provide useful information on the functional abilities in young and older SMA patients but appeared to work differently at the two extremes of the spectrum of abilities. The HFMS is more suitable in strong non-ambulant patients in whom there was a plateau of scores on the MFM20 associated with a much wider range of activities captured by the HFMS. The activities in the HFMS that were observed in patients with a plateau of MFM20 scores were propping and rolling, and other functional aspects assessed from prone, such as four point kneeling.

In contrast, the HFMS appeared to be less sensitive to record activities in the very weak patients, in axial and upper limb activities could be assessed using the MFM20. The paucity of items assessing upper limb performance in HFMS has recently been addressed as part of an international effort, with the development of a module assessing upper limb activities specifically designed and validated in non-ambulant SMA patients [20]. A multicentric cross sectional study confirmed

* Corresponding author. Department of Child Neurology, Policlinico Gemelli, Largo Gemelli, Roma 00168, Italy. Tel.: +39-06-30155340; fax: +39-06-30154363.
E-mail address: mercuri@rm.unicatt.it (E. Mercuri).
[1] Both authors contributed equally.

http://dx.doi.org/10.1016/j.nmd.2014.11.008
0960-8966/

that the ULM was able to assess a number of upper limb activities and axial strength even in the weak patients who had very low scores on the HFMS [20]. Since then the module has been used both in clinical and research settings but no longitudinal data have so far been reported.

The aim of this study was to establish possible 12 month changes in the ULM in a cohort of non-ambulant SMA patients and their correlation with the HFMSE.

2. Subject and methods

Patients attending the Neuromuscular Clinic of the Catholic University in Rome were enrolled in the present longitudinal study if (i) had a genetically confirmed diagnosis of SMA with a homozygous deletion of exon7 in the SMN1 gene, (ii) were non-ambulant, (iii) did not have unstable medical conditions that would preclude participation. To reduce selection bias, all patients seen in the neuromuscular clinics who fulfilled eligibility criteria were consecutively offered enrollment until the target of recruitment was reached. Patients with albuterol were not excluded but as is our experience that the effect of the drug is at its peak at 6 months after administration with a further minimal improvement between 6 and 12 months [16], we did not include those who had started albuterol in the 12 months before baseline. The study was approved by the Ethics Committee of the Catholic University.

2.1. ULM

The ULM [20] includes 9 items that can be performed using very little equipment (pencil, coin, plastic cup, button, lamp, can, weights), which is easily standardized.

Each item can be scored on a three point scale using simple criteria: 2 – Normal – achieves goal without any assistance; 1 – Modified method but achieves goal independent of physical assistance from another person; 0 – Unable to achieve independently.

A total score can be achieved by summing the scores for all the individual items. The score can range from 0, if all the activities are failed, to 18, if all the activities are achieved.

2.2. HFMSE

The scale [5,6] consists of 33 items, investigating the child's ability to perform various activities. Each activity (item) is scored on a 3 point scoring system, with a score of 2 for unaided, 1 for assistance and 0 for inability. The only exceptions are the activities of lying from sitting and lifting the head from prone, in which 1 cannot be scored. A total score can be achieved by summing the scores for all the individual items. The total score can range from 0, if all the activities are failed, to 66, if all the activities are achieved. All items have to be tested without spinal jacket or orthoses.

2.3. Statistical analysis

Correlations were evaluated by the Spearman rank correlation coefficients.

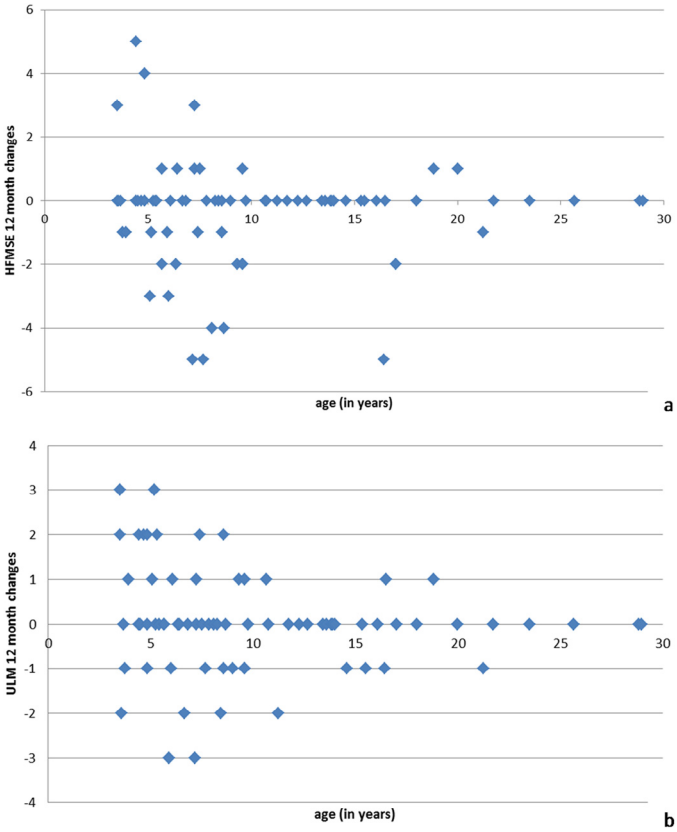

Fig. 1. ULM (a) and HFMSE (b) 12-month changes: individual details according to age.

3. Results

Seventy-four non-ambulant patients performed both measures at baseline and 12 months later. Seventy were type 2 and 4 type 3 who lost ambulation, age range 3.5–29.0 years (mean 10.22, SD 6.15). All the patients were on albuterol.

3.1. ULM

The ULM scores ranged between 0 and 17 (mean 10.23, SD 4.81) at baseline and between 1 and 17 at 12 months. The mean 12-month score was 10.27 (SD 4.74). The changes between baseline and 12 month ranged between −3 and 3 (mean change 0.04, SD 1.17).

Fig. 1a shows individual details of the distribution of scores according to age.

3.2. HFMSE

The HFMSE scores ranged between 0 and 34 (mean 12.43, SD 9.13) at baseline and between 0 and 34 at 12 months. The mean 12-month score was 12.08 (SD 9.21). The changes between baseline and 12 month ranged between −5 and 5 (mean change −0.35, SD 1.70).

Fig. 1b shows individual details of the distribution of scores according to age.

3.3. Correlation between ULM and HFMSE

The correlation between the ULM and HFMSE at baseline was 0.6553 (Fig. 2).