XVIII SIAMOC congress, Torino

# Stabilometric testing in Hereditary Spastic Paraplegia with SPG11 gene mutations: preliminary results

**A. Leporini[1], V. Maltese[1], C. Palmisano[1,2] , M. Casadio[3], S. Klebe [4], I. U. Isaias[1,5]**

*1. University Hospital and Julius-Maximilian-University, Wuerzburg, Germany*
*2. Movement Biomechanics and Motor Control MBMC Lab, TBM lab, DEIB, Politecnico di Milano, Milan, Italy*
*3. Università degli studi di Genova, DIBRIS, Genoa, Italy*
*4. University Hospital Freiburg, Freiburg, Germany*
*5. Centro Parkinson, ASST Gaetano Pini-CTO, Milan, Italy*

## Introduction

The Hereditary Spastic Paraplegia (HSP) with mutation in the SPG11 gene are rare neurodegenerative disorders, which present the hallmark of lower limb spasticity and paresis, combined with a variable degree of cognitive impairment. In physical examination, spasticity is measured using passive muscle tests. However, for accurate treatment planning and evaluation it is of relevance to understand the effect of spasticity also during functional tasks [1].

The purpose of this study was to see if static stabilometric testing alone could be useful in defining spastic symptoms in such a complicated form of HSP.

## Methods

• **Subjects**: Six HSP patients with SPG11 mutations (4M, age: 24±3 years, disease duration: 10±6 years, Spastic Paraplegia Rating Scale [SPRS]: 27±7) and ten age matched healthy controls (HC, 7M, age: 26±2 years)

• **Experimental setup**: Subjects performed at least three standing trials on two dynamometric force plates (Kistler, 9260AA) for 60s, in the morning after suspension of antispastic-therapy. Kinematic measurements were evaluated by means of an optoelectronic system (SMART DX, BTS).

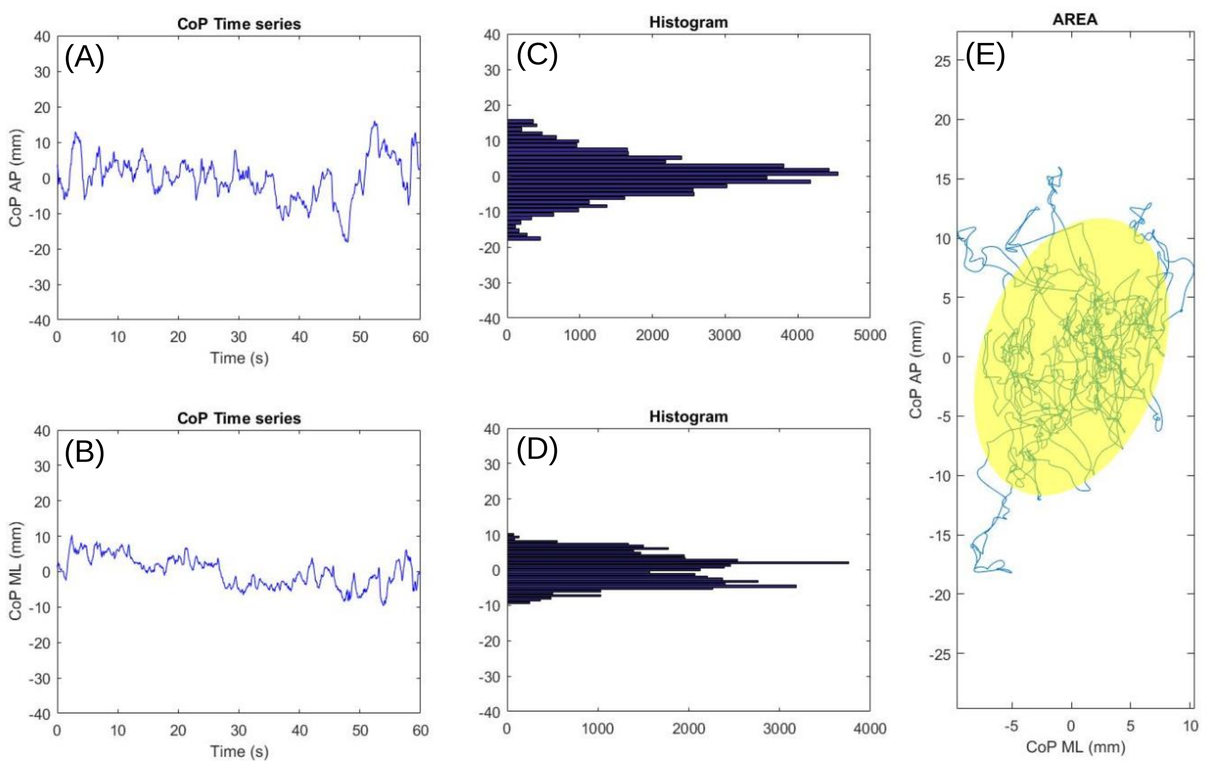


**Figure**. Example of pathological subject for 60s. (A,B) Mono-dimensional time series in AP and ML direction. (C,D) Histogram AP and ML direction. (E) 2D CoP trajectory in the horizontal ellipse.

•**Biomechanical measurement**: we analyzed the length of CoP trajectory, the anterior-posterior (A-P) and the medial-lateral (M-L) range (as a percentage of the foot length), the mean velocity and ellipse confidence of CoP (as percentage of the support base) [2]. We also measured the position of the CoP (in the A-P direction) relative to its average position and normalized it with respect to the total displacement range (Figure). Such observations of the CoP positioning was grouped in percentiles. We calculated the percentage of the sum of the observations exceeding the two 20th percentiles (most anterior and posterior displacements of CoP range [AP20 %]).

Besides analyzing the entire recording time (i.e. 60s), we also compared the first (0-30s) and the second half (31-60s) of the acquisitions, to investigate the effect of increasing spasticity over time. We used the Mann–Whitney U test and the Wilcoxon matched pairs (being a pair the two time windows of the same acquisition of one patient) (JMP 13, SAS).

## Results

All biomechanical measurements differed significantly between HC and SPG11. Moreover, while no difference was found for HC over time (from 0-30s to 31-60s), SPG11 showed a significant reduction of CoP positioning in the outermost positions of A-P displacement (Table).

| | HC (0-60s) | HC (0-30s) | HC (31-60s) | HSP (0-60s) | HSP (0-30s) | HSP (31-60s) |
|---|---|---|---|---|---|---|
| **Length CoP (mm)** | 587.4* | 286.6 § | 299.1+ | 951.8* | 464.7 § | 487.1+ |
| **Range A-P CoP (%FL)** | 9.0* | 7.7 § | 7.6+ | 18.1* | 14.2 § | 19.4+ |
| **Mean Velocity CoP (mm/s)** | 9.8* | 9.6 § | 9.9+ | 14.8* | 15.5 § | 13.3+ |
| **Ellipse Area (%BoS)** | 0.1* | 0.1 § | 0.1+ | 0.7* | 0.6 § | 0.3+ |
| **AP20 %** | 14.3* | 19.0 § | 19.9+ | 16.2* | 26.6 §,# | 19.9+,# |

**Table.** Stabilometric parameters of HC and HSP over time (*, §, +, # p<0.05). SPG11 showed a significant reduction of CoP positioning in the outermost positions of A-P displacement.

## Discussion

SPG11 patients showed faster and more extensive CoP movements to maintain balance. The CoP signal positioned more often at the extremes of its A-P range in subjects with HSP than HC, showing higher postural instability. Increasing spasticity during the trial determined a reduction in the CoP sway. The only parameter capable to detect this change was the AP20 %. Future correlation with EMG recordings will provide a pathophysiological insight of this phenomenon.

## References

[1] Crenna P. Neurosci Biobehav Rev 1998;22:571-578
[2] Duarte M, et al. Rev Bras Fisioter. 2010; 14 (3):183-92

Corresponding author: leporini.alice@gmail.com