Botulinum toxin is prescribed for spasticity or spastic dystonia?

Lucio Marinelli, Luca Puce, Laura Mori, Carlo Trompetto

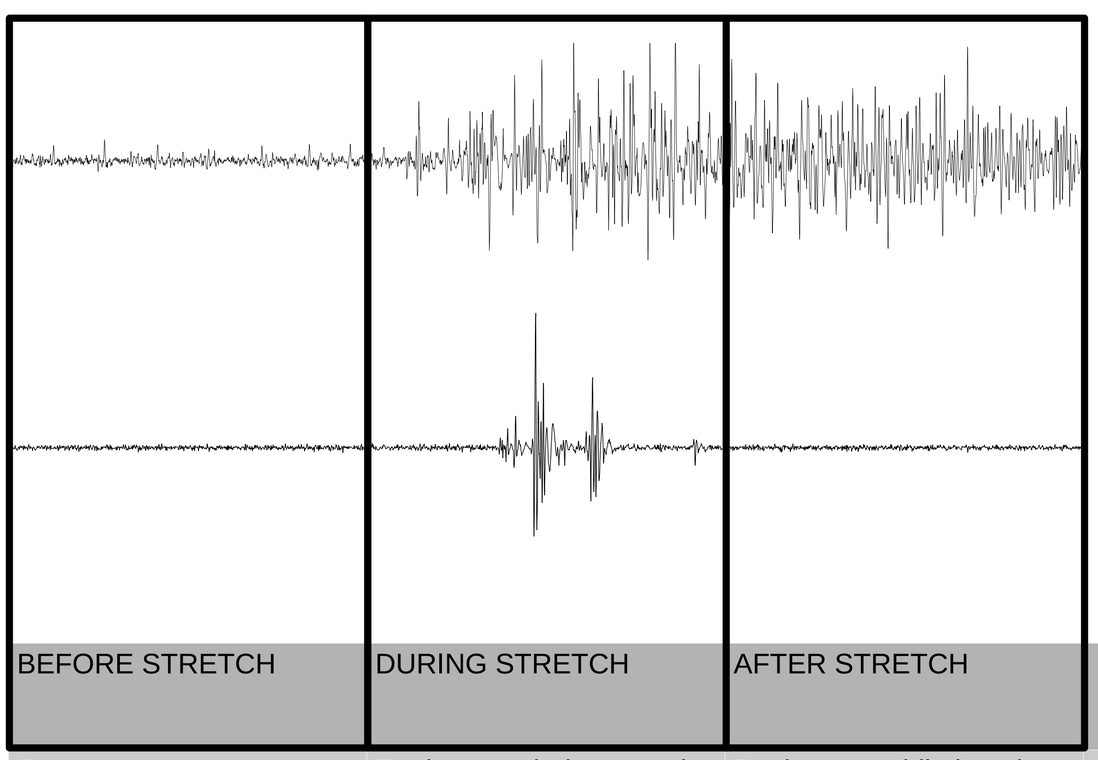
Department of Neuroscience, Rehabilitation, Ophthalmology, Genetics, Maternal and Child Health, University of Genova, Italy

UNIVERSITÀ DEGLI STUDI DI GENOVA

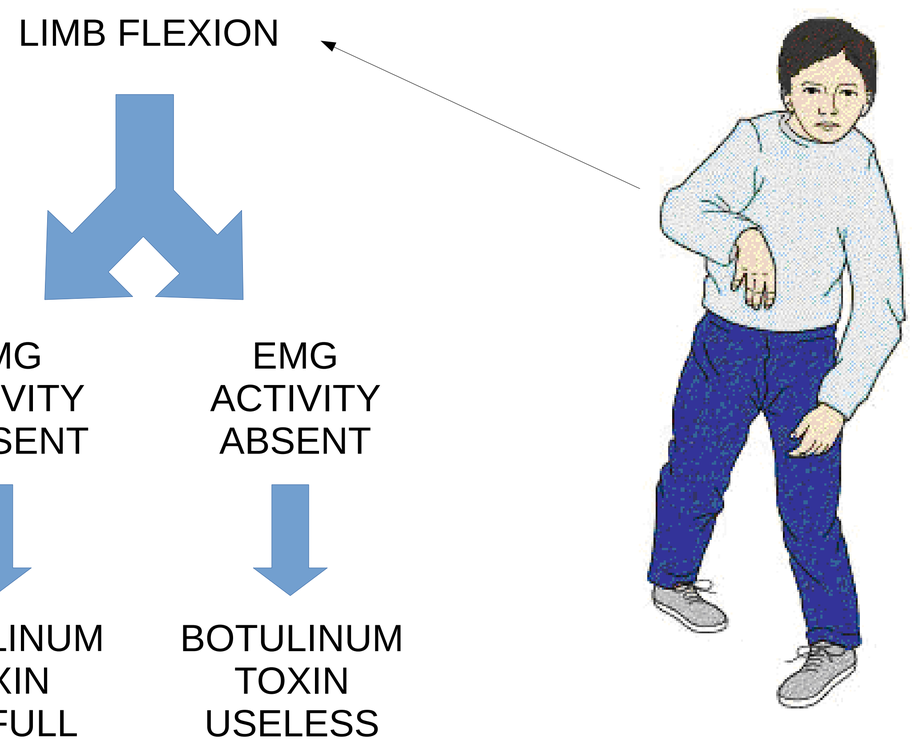
Introduction

Following clinical examination, botulinum toxin is injected in muscles perceived as hypertonic during passive stretches. An effective reduction of resistance during muscle elongation is often clearly appreciated as long as muscle motor units are preserved and the amount of fibrosis is low. Surface electromyography can be used to assess if resistance to passive muscle stretching is due to the activation of motor units, through recording of the generated electric activity. Spasticity is defined as a velocity-dependent increase of muscle tone associated with an increased stretch reflex in subjects with an upper motor neuron syndrome. A less well-known positive phenomenon called spastic dystonia can be responsible for generating the resistance to passive movements that leads the clinician to use botulinum toxin. Spastic dystonia is characterized by the inability to relax a muscle leading to a spontaneous, although stretch-sensitive, tonic contraction. Although spastic dystonia is a recognized cause of muscle hypertonia, its prevalence among hypertonic muscles of stroke subjects has never been investigated. The objective of this study is to understand the prevalence of spastic dystonia and spasticity in a group of stroke survivors presenting with muscle hypertonia where botulinum toxin treatment is indicated.

Subject	Gender	Age (years)	Lesion / affected side of the body	Time since stroke (months)	Modified Ashworth Scale		Strength (MRC)		Numeric Rating Scale		Deep Tendon Reflexes		
					Ext	Flex	Ext	Flex	Ext	Flex	BR	TR	BrR
1	F	43	Haemorrage/L	13	0	2	5	3	6	6	3	3	3
2	F	75	Infarction/R	11	1	3	3	1	2	10	4	3	3
3	F	68	Haemorrage/R	108	1	3	3	0	8	10	3	3	3
4	M	68	Haemorrage/L	49	0	3	4	2	2	6	3	3	3
5	M	78	Infarction/R	11	2	3	3	1	3	5	3	3	3
6	M	61	Infarction/L	6	0	2	5	3	0	5	3	2	3
7	M	71	Haemorrage/L	45	0	1	5	4	5	5	3	3	3
8	F	79	Infarction/R	22	0	1+	5	4	0	2	3	3	3
9	F	80	Haemorrage/R	124	0	2	0	0	0	0	3	3	3
10	M	74	Infarction/R	21	1	3	0	0	0	8	3	3	3
11	M	70	Infarction/L	20	0	3	0	0	2	5	4	3	3
12	M	66	Haemorrage/L	15	0	1+	3	1	5	5	3	2	3
13	M	59	Haemorrage/L	11	1	2	4	1	2	2	3	3	3
14	M	75	Infarction/R	9	0	3	0	0	0	9	3	3	3
15	M	67	Infarction/L	6	0	1+	5	4	0	1	3	2	3
16	F	74	Infarction/R	9	2	3	0	0	0	0	3	3	3
17	M	61	Infarction/L	32	0	3	5	4	1	0	3	3	3
18	M	71	Haemorrage/R	62	0	2	5	4	2	1	3	3	3
19	M	66	Infarction/L	36	0	1+	5	4	0	2	3	3	3
20	F	58	Infarction/R	34	2	2	0	0	2	5	3	3	3
21	M	68	Infarction/L	8	0	1	5	4	0	0	3	2	3
22	M	66	Infarction/L	36	0	1+	5	4	0	2	3	3	3
23	F	69	Infarction/R	49	0	1	5	5	0	0	3	3	3



Rest posture	Resistance during stretch	Resistance while keeping the muscle elongated	**CLINICAL FINDINGS**
EMG activity at rest	Stretch reflex	Static phase after stretch	**ELECTROMYOGRAPHY**



Examiners cannot tell if a posture is due to involuntary muscle activity or retraction without electromyography!
Resistance to passive stretch is present in both cases!

EMG ACTIVITY PRESENT:
IS IT SPASTICITY OR SPASTIC DYSTONIA?

SPASTICITY
Velocity-dependent increase of muscle tone associated with an increased stretch reflex in subjects with an upper motor neuron syndrome

SPASTIC DYSTONIA
Inability to relax a muscle leading to a spontaneous, although stretch-sensitive, tonic contraction in subjects with an upper motor neuron syndrome

SPASTIC DYSTONIA
EMG always present and increased by the stretch

SPASTICITY
EMG present only during the stretch

Methods

We recruited 23 hemiparetic stroke survivors showing increased muscle tone of wrist flexors where incobotulinumtoxinA was prescribed. Surface EMG was used to investigate the presence of spontaneous, stretch-sensitive EMG activity in flexor carpi radialis.

Results

Stretch-sensitive EMG activity was found in 17 subjects while the muscle was kept elongated. In the remaining 6 subjects, EMG activity was present only during the dynamic phase of muscle stretches.

Conclusions

The majority of stroke subjects is affected by spastic dystonia in their hypertonic wrist flexor muscles, while only a minority of subjects is affected by spasticity. Botulinum toxin is therefore more often used to treat spastic dystonia rather than spasticity. To stop spastic dystonia from being the neglected aspect of UMNS, it is essential to link its definition to increased muscle tone, as occurred for spasticity. Recognizing the real phenomena underling muscle hypertonia could improve its management.

References

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