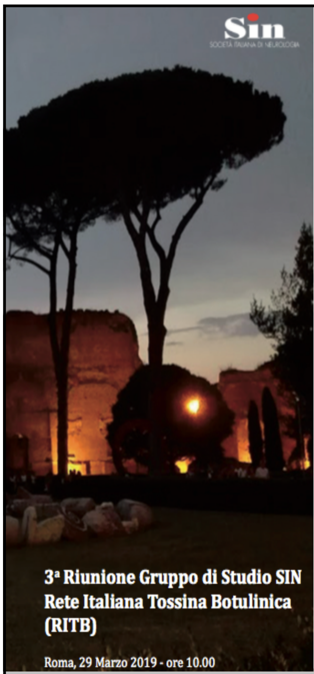

La spasticità dell'arto superiore: la diagnosi e il trattamento con BoNTA

Alessio Baricich
MD PhD

Medicina Fisica e Riabilitativa

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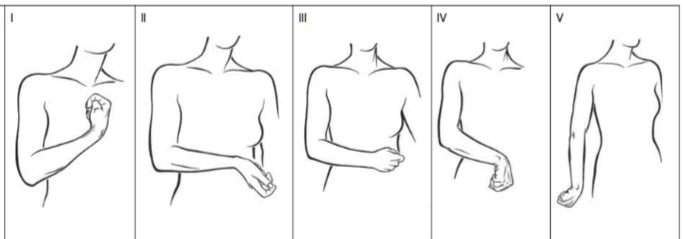
UNIVERSITÀ DEL PIEMONTE ORIENTALE

Ospedale Maggiore della Carità
Novara

Disclosures

- Honoraria/Expenses from Allergan, Ipsen
- Consulting/Advisory Board from Allergan, Ipsen
- Funded Research from Allergan, Ipsen, Merz

UL spasticity



	I	II	III	IV	V
Shoulder	Internal rotation/ adduction	Internal rotation/ adduction	Internal rotation/ adduction	Internal rotation/ adduction	Internal rotation/ retroversion
Elbow	Flexion	Flexion	Flexion	Flexion	Extension
Forearm	Supination	Supination	Neutral	Pronation	Pronation
Wrist	Flexion	Extension	Neutral	Flexion	Flexion

Upper limb spasticity patterns. Note: All five upper limb patterns could be combined with any spastic hand and finger position (e.g. claw, spastic flexed, intrinsic lumbrical).

Hefter et al, 2012

OnabotulinumtoxinA Injection for Upper Limb PSS

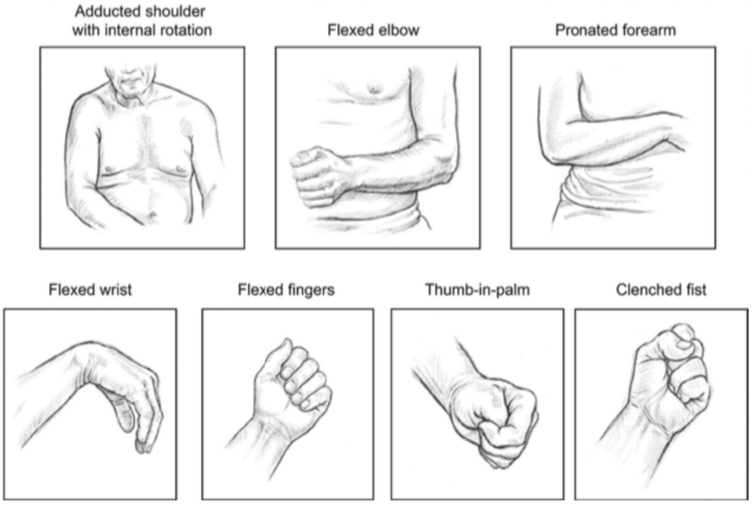


Figure 3. Post-Delphi revisions: final redrawn images for Common Postures of Spasticity Picture Guide: Upper Limb.

D.M. Simpson et al. / PM R 9 (2017) 136-148

Journal of Neurology
https://doi.org/10.1007/s00415-018-8759-1

ORIGINAL COMMUNICATION

CrossMark

Defining spasticity: a new approach considering current movement disorders terminology and botulinum toxin therapy

Dirk Dressler[1] · Roongroj Bhidayasiri[2] · Saeed Bohlega[3] · Pedro Chana[4] · Hsin Fen Chien[5] · Tae Mo Chung[6] · Carlo Colosimo[7] · Markus Ebke[8] · Klemens Fedoroff[9] · Bernd Frank[10] · Ryuji Kaji[11] · Petr Kanovsky[12] · Serdar Koçer[13] · Federico Micheli[14] · Olga Orlova[15] · Sebastian Paus[16] · Zvezdan Pirtosek[17] · Maja Relja[18] · Raymond L. Rosales[19] · José Alberto Sagástegui-Rodríguez[20] · Paul W. Schoenle[21] · Gholam Ali Shahidi[22] · Sofia Timerbaeva[23] · Uwe Walter[24] · Fereshte Adib Saberi[25]

Spasticity: definition

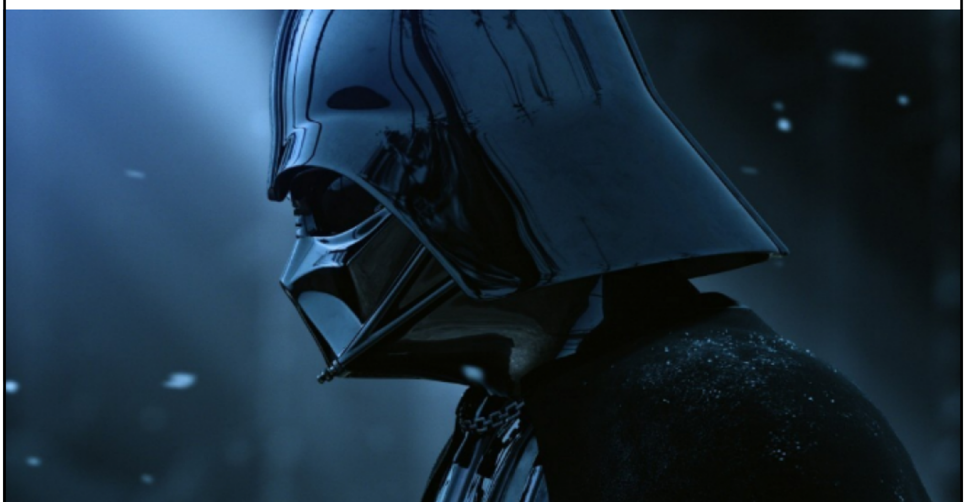
The involuntary muscle hyperactivity can consist of various forms of muscle hyperactivity:

- **spasticity sensu strictu**: involuntary muscle hyperactivity triggered by rapid passive joint movements
- **rigidity**: involuntary muscle hyperactivity triggered by slow passive joint movements
- **dystonia**: spontaneous involuntary muscle hyperactivity
- **spasms**: complex involuntary movements usually triggered by sensory or acoustic stimuli.
- **complications**: contractures, pain

Dressler et al, J Neurol 2018

Indication	Level A[a] effective	Level B[b] probably effective
Blepharospasm		OnabotulinumtoxinA incobotulinumtoxinA
Cervical dystonia	AbobotulinumtoxinA, rimabotulinumtoxinB	OnabotulinumtoxinA incobotulinumtoxinA
Upper limb spasticity[g]	AbobotulinumtoxinA, onabotulinumtoxinA,[h] incobotulinumtoxinA	Rimabotulinumtoxin
Lower limb spasticity	OnabotulinumtoxinA, abobotulinumtoxinA	
Chronic migraine	OnabotulinumtoxinA[i]	
Episodic migraine		
Tension-type headache		

Simpson DM et al, Neurology 2016



Botulinum Toxin for the Upper Limb After Stroke (BoTULS) Trial
Effect on Impairment, Activity Limitation, and Pain

Lisa C. Shaw, MRCP; Christopher I.M. Price, MD; Frederike M.J. van Wijck, PhD; Phil Shackley, PhD; Nick Steen, PhD; Michael P. Barnes, MD; Gary A. Ford, FRCP; Laura A. Graham, MD; Helen Rodgers, FRCP; on behalf of the BoTULS Investigators

- No significant difference in achievement of improved arm function (Action Research Arm Test) at 1 month (intervention group: 42 of 167 [25.1%], control group 30 of 154 [19.5%]; *P* 0.232).
- Significant differences in favor of the intervention group were seen in muscle tone at 1 month; upper limb strength at 3 months; basic arm functional tasks (hand hygiene, facilitation of dressing) at 1, 3, and 12 months; and pain at 12 months.

(*Stroke*. 2011;42:1371-1379.)

Safety and efficacy of abobotulinumtoxinA for hemiparesis in adults with upper limb spasticity after stroke or traumatic brain injury: a double-blind randomised controlled trial

*Jean-Michel Gracies, Allison Brashear, Robert Jech, Peter McAllister, Marta Banach, Peter Valkovic, Heather Walker, Christina Marciniak, Thierry Deltombe, Alexander Skoromets, Svetlana Khatkova, Steven Edgley, Fatma Gul, France Catus, Beatrice Bois De Fer, Claire Vilain, Philippe Picaut, for the International AbobotulinumtoxinA Adult Upper Limb Spasticity Study Group**

Added value of this study

The current study shows improvements in tone 4 weeks after a single injection session of 500 U or 1000 U of abobotulinumtoxinA; these improvements were noted as early as week 1 and persisted for at least 12 weeks. Tertiary endpoints showed an improvement in active range of motion in all movements assessed in the upper limb (elbow, wrist, or finger extension) in the abobotulinumtoxinA 1000 U group, and a reduction of spasticity and spastic dystonia (Tardieu Scale). The data obtained with the two doses we studied and their effects might provide relevant information for future recommendations on dosing of abobotulinumtoxinA in adults with spastic paresis.

Lancet Neurol 2015; 14: 992–1001

Botulinum toxin A for upper limb spasticity

Overall, the study by Gracies and colleagues shows that an injection of abotulinumtoxinA is safe to apply and results in significantly reduced muscle tone for up to 3 months after stroke or traumatic brain injury.

However, whether Botulinum toxin A injections are useful for improving upper limb capacity remains unsolved.

*Gert Kwakkel, Carel G M Meskers

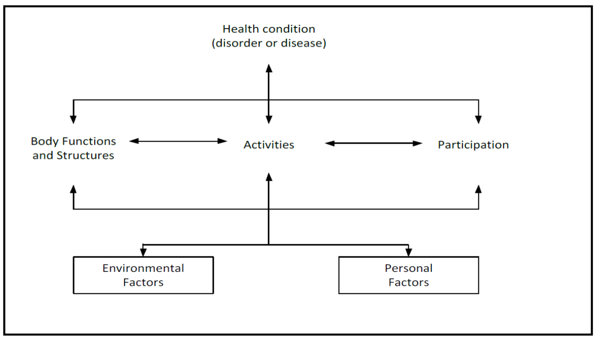
Published Online
August 27, 2015
http://dx.doi.org/10.1016/S1474-4422(15)00222-7

See Articles page 992

www.thelancet.com/neurology Vol 14 October 2015

Il problema della misura

Box 1: The ICF Model: Interaction between ICF components



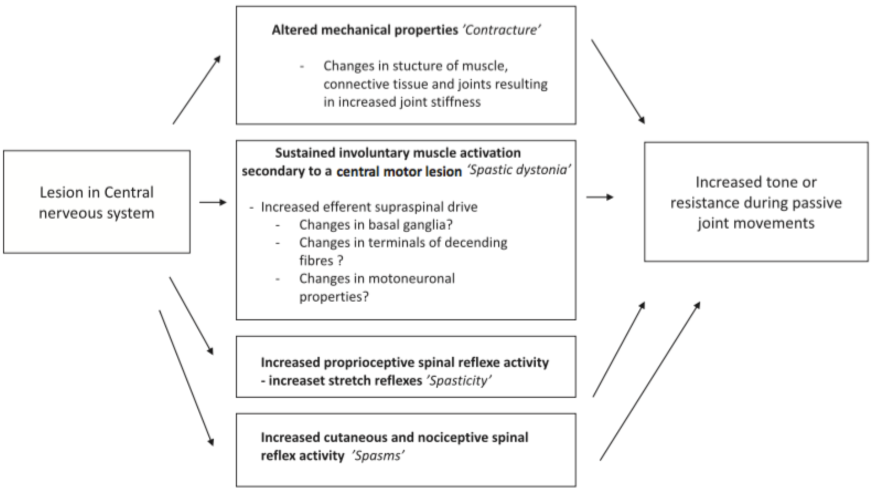
WHO 2001, 18

RESEARCH ARTICLE

Systematic Review of Upper-limb Function Measurement Methods in Botulinum Toxin Intervention for Focal Spasticity

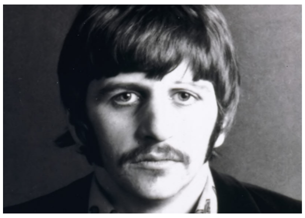
Stephen Ashford[1,2†] & Lynne Turner-Stokes[1,2‡]

Physiother. Res. Int. **18** (2013) 178–189



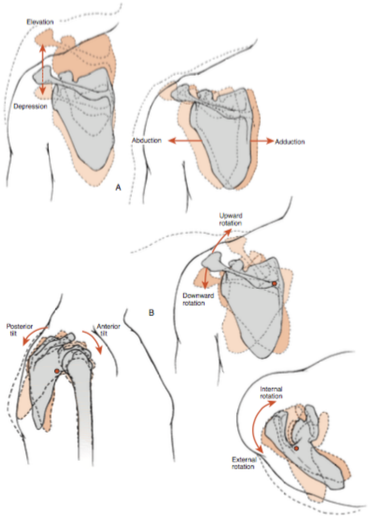
J. Lorentzen et al. / Clinical Neurophysiology 129 (2018) 89–94

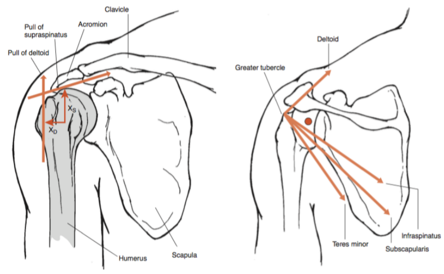
Cos'è la "funzione attiva"?



Michelangelo Buonarroti, 1508-1512

Jac Jacobsen, 1937





Oatis CA, 2009

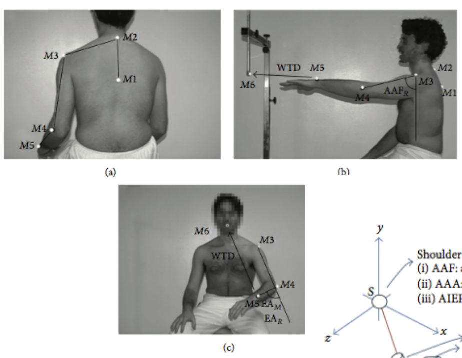
Hindawi Publishing Corporation
BioMed Research International
Volume 2015, Article ID 484131, 14 pages
http://dx.doi.org/10.1155/2015/484131

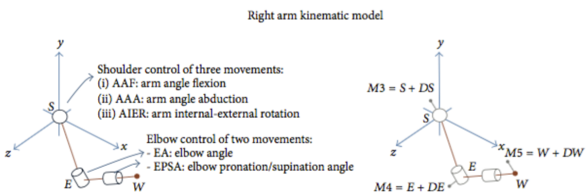
Hindawi

Research Article

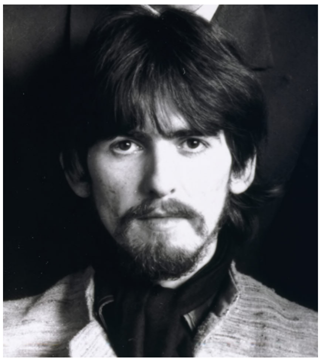
Normative Data for an Instrumental Assessment of the Upper-Limb Functionality

Marco Caimmi,[1,2,3] Eleonora Guanziroli,[2] Matteo Malosio,[1,3] Nicola Pedrocchi,[1] Federico Vicentini,[1] Lorenzo Molinari Tosatti,[1] and Franco Molteni[2]





Il "problema" spasticità



Acta Neurologica Scandinavica

Acta Neurol Scand 2013: 128: 305–310 DOI: 10.1111/ane.12128

ACTA NEUROLOGICA SCANDINAVICA

Review Article

Enhancing patient–provider communication for long-term post-stroke spasticity management

Sunnerhagen KS, Francisco GE. Enhancing patient–provider communication for long-term post-stroke spasticity management. Acta Neurol Scand 2013: 128: 305–310.

K. S. Sunnerhagen[1], **G. E. Francisco**[2]

[1]The Institute of Neuroscience and Physiology – Section for Clinical Neuroscience and Rehabilitation,

letter to the editor

Post-stroke spasticity as a condition: a new perspective on patient evaluation

Alessio Baricich, MD[a], Alessandro Picelli, MD, PhD[b], Franco Molteni, MD[c],
Eleonora Guanziroli, MS Biomed Eng, PhD[c], Andrea Santamato, MD[d]
on behalf of the Philosophical Botulinum Toxin Club

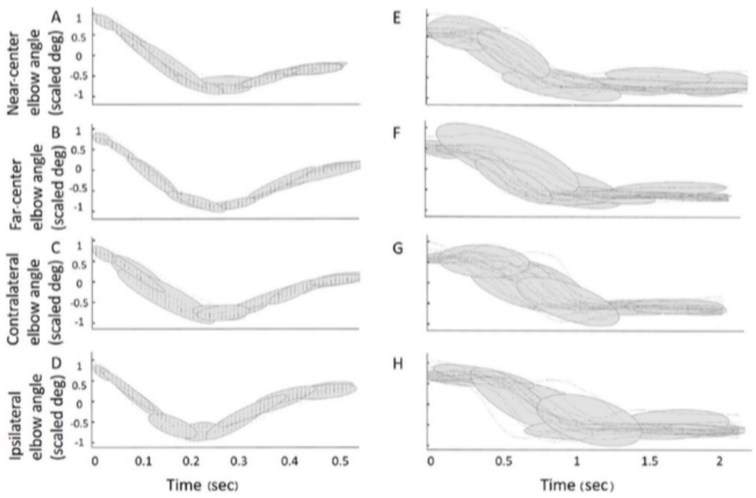
Functional Neurology 2016; 31(3): 179-180

Relationship Between Spasticity and Upper-Limb Movement Disorders in Individuals With Subacute Stroke Using Stochastic Spatiotemporal Modeling

Neurorehabilitation and
Neural Repair
2019, Vol. 33(2) 141–152

DOI: 10.1177/1545968319826050
journals.sagepub.com/home/nnr
SAGE

Isgav Davidowitz, MSc[1], Yisrael Parmet, MSc, PhD[1], Silvi Frenkel-Toledo, MSc, PhD[2,3], Melanie C. Baniña, CAT(C), MSc, PhD[4,5], Nachum Soroker, MD, PhD[3,6], John M. Solomon, MPT, PhD[7], Dario G. Liebermann, MSc, PhD[6], Mindy F. Levin, PT, MSc, PhD[2,3], and Sigal Berman, MSc, PhD[1]



Davidowitz I et al, NNR 2019

J Rehabil Med 2019; 51: Epub ahead of print

SHORT COMMUNICATION

Check for updates

SPASTIC CO-CONTRACTION, RATHER THAN SPASTICITY, IS ASSOCIATED WITH IMPAIRED ACTIVE FUNCTION IN ADULTS WITH ACQUIRED BRAIN INJURY: A PILOT STUDY

Alexandre CHALARD, PT, MS[1,2], David AMARANTINI, PhD[1], Joseph TISSEYRE, MS[1], Philippe MARQUE, MD, PhD[1,3], Jessica TALLET, PhD[1] and David GASQ, MD, PhD[1,4]

- Greater co-contraction occurred in patients with brain injury compared with controls.
- In contrast to spasticity, strong associations were found between the co-contraction index, the limitation of active elbow extension, the Fugl-Meyer Assessment, and the Action Research Arm Test.

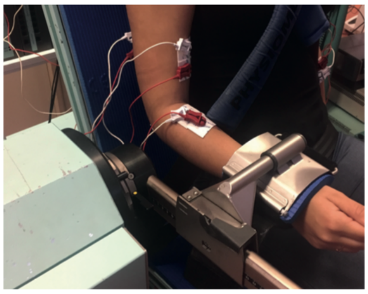
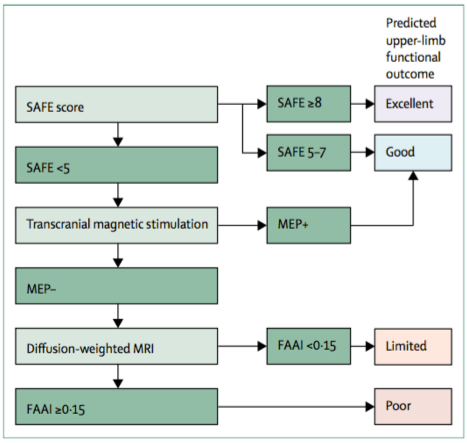


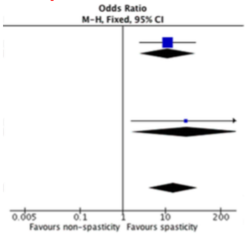
Fig. 1. Illustration of the arm and forearm positions used to perform torque and electromyographic recordings during isometric elbow extension on the calibrated dynamometer.

La prognosi funzionale

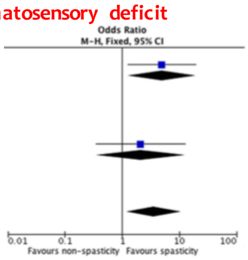


Stinear et al, 2017

Motor impairment



Somatosensory deficit



Key messages

- Motor impairments, sensory deficits, haemorrhagic stroke and stroke were identified as a significant predictors of upper limb spasticity.
- Future work should explore the biomechanical and neurophysiological factors contributing to spasticity.

L. Tedesco Triccas, N. Kennedy, T. Smith, et al. / Physiotherapy xxx (2019) xxx–xxx

Letter by Munin et al Regarding Article, "Botulinum Toxin for the Upper Limb After Stroke (BoTULS) Trial: Effect on Impairment, Activity Limitation, and Pain"
Michael C. Munin, Douglas J. Weber and Elizabeth R. Skidmore

Stroke. 2011;42:e412; originally published online June 2, 2011;

- ❑ **With severe baseline weakness in a majority of subjects, it is not surprising that botulinum toxin injections that block neuromuscular transmission and cause selective muscle weakening did not improve active functional movement as measured by the ARAT.**
- ❑ Significantly more abobotulinumtoxinA patients had improvement in subject-reported daily tasks, like opening the palm for cleaning and cutting nails and putting an arm through a coat sleeve.
- ❑ These findings indicate that different measures give us different information about the effectiveness of interventions on upper limb function and pose the question, which measures are best for measuring changes in upper limb spasticity after stroke?

ACRM
AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Physical Medicine and Rehabilitation
journal homepage: www.archives-pmr.org
Archives of Physical Medicine and Rehabilitation 2013;94:977-89

REVIEW ARTICLE (META-ANALYSIS)

Treatment With Botulinum Toxin Improves Upper-Extremity Function Post Stroke: A Systematic Review and Meta-Analysis

Norine Foley, MSc,[a] Shelialah Pereira, MSc,[a] Katherine Salter, MSc,[a] Manuel Murie Fernandez, PhD,[b] Mark Speechley, PhD,[c] Keith Sequeira, MD,[d,e] Thomas Miller, MD,[a,d,e] Robert Teasell, MD[a,d,e]

Table 3 Treatment effect sizes grouped by similarity of outcome

Measure	Outcome Type	Standardized Mean Difference (95% Confidence Interval), *P* value
Disability Assessment Scale Disability Scale	Scales developed specifically to assess response to treatment with BTX-A	0.688 (0.454–1.012), *P*<.0001
Action Research Arm Test Motor Assessment Scale Motor Activity Log	Assessments of motor function	0.406 (0.85–0.727), *P*=.013
Barthel Index	Generalized disability	0.372 (−0.002 to 0.746), *P*=.051

J Rehabil Med 2014; 46: 504–513

ORIGINAL REPORT

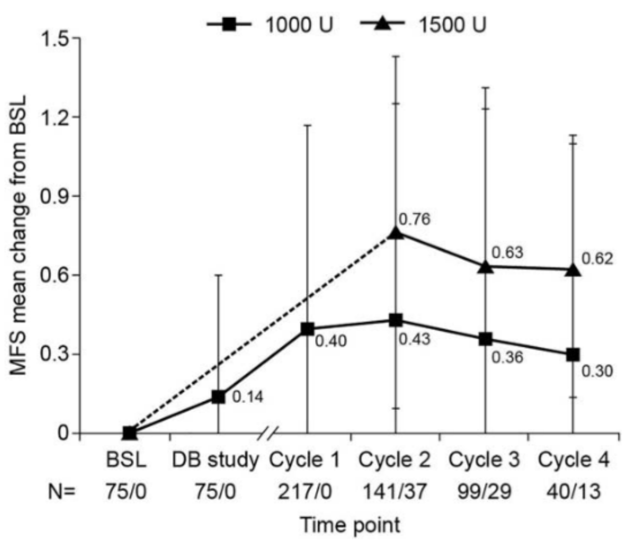
FUNCTIONAL GOAL ACHIEVEMENT IN POST-STROKE SPASTICITY PATIENTS: THE BOTOX® ECONOMIC SPASTICITY TRIAL (BEST)

Anthony B. Ward, MD, FRCP[1], Jörg Wissel, MD, FRCP[2], Jörgen Borg, MD[3], Per Ertzgaard, MD[4], Christoph Herrmann, MD[5], Jai Kulkarni, MD, FRCP[6], Kristina Lindgren, MD[7], Iris Reuter, MD[8], Mohamed Sakel, FRCP[9], Patrik Säterö, MD[10], Satyendra Sharma, MD, FRCPC[11], Theodore Wein, MD, FRCPC[12], Nicola Wright, MSc[13] and Antony Fulford-Smith, MB, BS, MRCGP[13]; on behalf of the BEST study group

Table VI. *Level of principal active functional goal attainment, assessed at week 24, or 10 weeks after the second injection*

	OnabotulinumtoxinA + SC	Placebo + SC
Upper limb principal active functional goals[a], ITT population (assessable patients), *n*	*n*=62 (*n*=54)	*n*=62 (*n*=52)
+2	3 (5.6)	1 (1.9)
+1	7 (13.0)	3 (5.8)
0	11 (20.4)	9 (17.3)
–1	19 (35.2)	16 (30.8)
–2	12 (22.2)	20 (38.5)
–3	2 (3.7)	3 (5.8)
Median	–1	–1
Median difference (95% CI); *p*-value	0.0 (0.0 to 1.0); *p*=0.034	
Lower limb principal active functional goals[a], ITT population (assessable patients), *n*	*n*=77 (*n*=69)	*n*=72 (*n*=66)
+2	3 (4.3)	11 (16.7)
+1	9 (13.0)	5 (7.6)
0	18 (26.1)	14 (21.2)
–1	17 (24.6)	12 (18.2)
–2	19 (27.5)	21 (31.8)
–3	3 (4.3)	3 (4.5)
Median	–1	–1
Median difference (95% CI); *p*-value	0.0 (–1.0 to 0.0); *p*=0.724	

[a]ITT: intention-to-treat; [b]SC: standard of care.



Gracies et al, Muscle & Nerve 2018

Influence of Botulinum Toxin Type A Treatment of Elbow Flexor Spasticity on Hemiparetic Gait

ABSTRACT

Esquenazi A, Mayer N, Garreta R: Influence of botulinum toxin type A treatment of elbow flexor spasticity on hemiparetic gait. Am J Phys Med Rehabil 2008; 87:305–311.

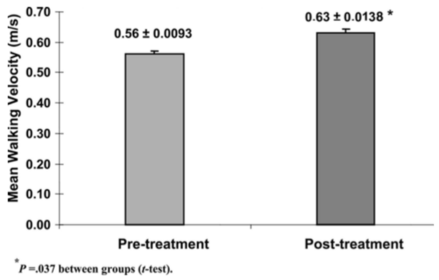


FIGURE 1 *Change in self-selected comfortable walking velocity. *P = 0.037 between groups (t test).*

Letter by Munin et al Regarding Article, "Botulinum Toxin for the Upper Limb After Stroke (BoTULS) Trial: Effect on Impairment, Activity Limitation, and Pain"

Michael C. Munin, Douglas J. Weber and Elizabeth R. Skidmore

Stroke. 2011;42:e412; originally published online June 2, 2011;

- Because functional improvement was the primary outcome of this trial, inaccurate placement of toxin combined with suboptimal dosing of limited numbers of muscles may explain why the intervention group did not show improvement in ARAT relative to controls.

PM R 9 (2017) 136-148

www.pmrjournal.org

Original Research

OnabotulinumtoxinA Injection for Poststroke Upper-Limb Spasticity: Guidance for Early Injectors From a Delphi Panel Process

David M. Simpson, MD, Atul T. Patel, MD, Abraham Alfaro, PhD, DO, Ziyad Ayyoub, MD, David Charles, MD, Khashayar Dashtipour, MD, PhD, Alberto Esquenazi, MD, Glenn D. Graham, MD, John R. McGuire, MD, Ib Odderson, MD, PhD

Adducted Shoulder*	Muscles: Pectoralis Complex	Latissimus Dorsi	Technique and Total Dose
Panelists (%) recommending injection of this muscle	87.5	75	LT: yes†
OnabotulinumtoxinA dose, U (mode)	75	75	150
OnabotulinumtoxinA dose, U (range)	75-100	75	100-200
Number of injection sites per muscle	4	4	

Flexed Elbow	Muscles: Brachioradialis	Biceps Brachii	Brachialis	Technique and Total Dose
Panelists (%) recommending injection of this muscle	100	87.5	75	LT: yes†
OnabotulinumtoxinA dose, U (mode)	25	50	75	150
OnabotulinumtoxinA dose, U (range)	25-50	0-50	50-100	100-150
Number of injection sites per muscle	2	4	2	

Pronated Forearm	Muscles: Pronator Quadratus	Pronator Teres	Technique and Total Dose
Panelists (%) recommending injection of this muscle	100	100	LT: yes†
OnabotulinumtoxinA dose, U (mode)	25	50	75
OnabotulinumtoxinA dose, U (range)	0-25	45-60	50-100
Number of injection sites per muscle	1	2	

Muscles

D.M. Simpson et al. / PM R 9 (2017) 136-148

Flexed Wrist	Muscles: Flexor Carpi Radialis	Muscles: Flexor Carpi Ulnaris	Technique and Total Dose
Panelists (%) recommending injection of this muscle	100	100	LT: yes[†]
OnabotulinumtoxinA dose, U (mode)	50	50	100
OnabotulinumtoxinA dose, U (range)	50-75	25-50	60-100
Number of injection sites per muscle	2	2	

Flexed Fingers	Muscles: Flexor Digitorum Superficialis	Muscles: Flexor Digitorum Profundus	Technique and Total Dose
Panelists (%) recommending injection of this muscle	100	100	LT: yes[†]
OnabotulinumtoxinA dose, U (mode)	50	50	100
OnabotulinumtoxinA dose, U (range)	20-60	25-75	50-100
Number of injection sites per muscle	2	2	

Thumb-in-palm	Muscles: Flexor Pollicis Longus	Muscles: Adductor Pollicis	Muscles: Flexor Pollicis Brevis	Technique and Total Dose
Panelists (%) recommending injection of this muscle	100	87.5	87.5	LT: yes[†]
OnabotulinumtoxinA dose, U (mode)	40	15	20	75
OnabotulinumtoxinA dose, U (range)	40-50	10-20	12.5-20	50-75
Number of injection sites per muscle	2	1	1	

Clenched Fist	Muscles: Flexor Digitorum Superficialis	Muscles: Flexor Digitorum Profundus	Muscles: Flexor Pollicis Brevis	Muscles: Flexor Pollicis Longus	Muscles: Adductor Pollicis Longus	Technique and Total Dose
Panelists (%) recommending injection of this muscle	100	100	75	100	75	LT: yes[†]
OnabotulinumtoxinA dose, U (mode)	50	50	15	25	10	150
OnabotulinumtoxinA dose, U (range)	40-50	25-60	10-15	25-30	10-12.5	125-175
Number of injection sites per muscle	2	2	1	2	1	

D.M. Simpson et al. / PM R 9 (2017) 136-148

Three most common aggregate postures

	Aggregate Postures	Starting Dose (Typical)	Total Dose (Maximum)
1	Adducted shoulder Flexed elbow Pronated forearm Flexed wrist Clenched fist	300 U	400 U
2	Flexed elbow Pronated forearm Flexed wrist Clenched fist	300 U	400 U
3	Flexed wrist Clenched fist	200 U	300 U

D.M. Simpson et al. / PM R 9 (2017) 136-148

J Rehabil Med 2011; 43: 1032–1037

ORIGINAL REPORT

INVESTIGATING MUSCLE SELECTION FOR BOTULINUM TOXIN-A INJECTIONS IN ADULTS WITH POST-STROKE UPPER LIMB SPASTICITY

Ian J. Baguley, MBBS PhD[1], Melissa T. Nott, PhD[1], Lynne Turner-Stokes, DM FRCP[2], Stephen De Graaff, MBBS FAFRM[3], Pesi Katrak, MD FAFRM[4], Paul McCrory, MBBS PhD FRACP[5], Monica de Abadal, MD MBA/HSA[6] and Andrew Hughes, MD[7]

- Muscle selection and botulinum toxin-A dosage were not significantly associated with spasticity severity or with patient-identified goals.
- Between-site differences in injection practices suggested that injector beliefs, rather than patient characteristics, were the dominant feature driving botulinum toxin-A injection strategy for post-stroke upper limb spasticity.
- This result looks into the "black box" of reha- bilitation, revealing signi cant variation in injector beliefs

MANUAL NEEDLE PLACEMENT: ACCURACY OF BOTULINUM TOXIN A INJECTIONS

ALEXIS SCHNITZLER, MD,[1] NICHOLAS ROCHE, MD,[1] PHILIPPE DENORMANDIE, MD,[2] CHRISTINE LAUTRIDOU, MD,[2] BERNARD PARRATTE, MD, PhD,[3] and FRANÇOIS GENET, MD[1]

[1] Physical Medicine and Rehabilitation Department, Raymond Poincaré Hospital, AP-HP, University of Versailles Saint Quentin, 104 Boulevard Raymond Poincaré, 92380 Garches, France
[2] Orthopaedic Surgery Department, Raymond Poincaré Hospital, AP-HP, University of Versailles Saint Quentin, Garches, France
[3] Physical Medicine and Rehabilitation Department, University of J Minjoz, Besançon, France

Accepted 6 April 2012

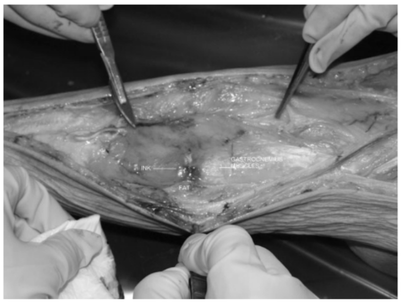


FIGURE 1. Successful injection (ink in the gastrocnemius muscle).

FIGURE 2. Unsuccessful injection (superficial, ink in the fat).

Muscle Nerve **46:** 531–534, 2012

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REVIEW ARTICLE

Impact of Injection-Guiding Techniques on the Effectiveness of Botulinum Toxin for the Treatment of Focal Spasticity and Dystonia: A Systematic Review

Anca-Irina Grigoriu, MD, MSc,[a] Mickael Dinomais, MD, PhD,[b,c] Olivier Rémy-Néris, MD, PhD,[a,d,e] Sylvain Brochard, MD, PhD[a,d,e]

Conclusions: These results strongly recommend instrumented guidance of BoNT-A injection for the treatment of spasticity in adults and children (ES or US), and of focal dystonia such as spasmodic torticollis (EMG). No specific recommendations can be made regarding the choice of instrumented guiding technique, except that US appears to be more effective than ES for spastic equinus in adults with stroke.

European Journal of Physical and Rehabilitation Medicine 2018 June;54(3):469-85
DOI: 10.23736/S1973-9087.17.04664-0

SPECIAL ARTICLE

Sonographic guide for botulinum toxin injections of the upper limb: EUROMUSCULUS/USPRM spasticity approach

Murat KARA [1] *, Bayram KAYMAK [1], Alper M. ULAŞLI [2], Fatih TOK [3], Gökhan T. ÖZTÜRK [2], Ke-Vin CHANG [4], Ming-Yen HSİAO [4], Chen-Yu HUNG [5], Arzu YAĞIZ ON [6], Levent ÖZÇAKAR [1]

Take home messages

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See Articles page 992

*Gert Kwakkel, Carel G M Meskers

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Take home messages

- In view of this complexity, it is not surprising that a treatment to counteract the hyperexcitability component of spasticity does not automatically result in improved upper limb function.

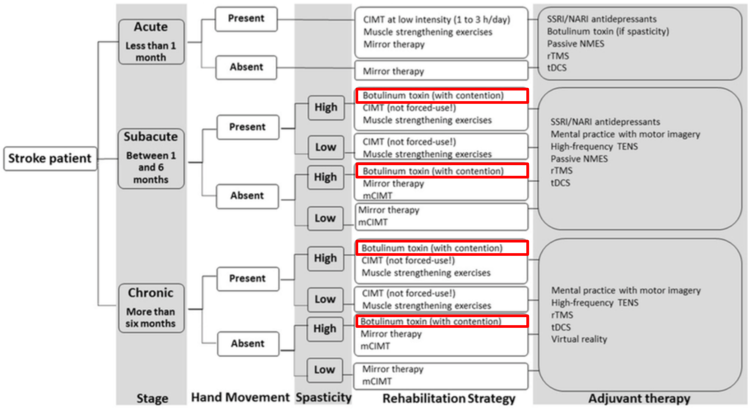
- There is increasing evidence that the effects of botulinum toxin A injections can be maximised by a team of health professionals such as nurses, physical and occupational therapists, and orthotists, who collectively aim to improve upper limb capacity, improve basic upper limb activities such as hand hygiene and dressing ability, or reduce deformity and pain after stroke or traumatic brain injury.

*Gert Kwakkel, Carel G M Meskers www.thelancet.com/neurology Vol 14 October 2015

frontiers in Human Neuroscience
REVIEW
published: 13 September 2016
doi: 10.3389/fnhum.2016.00442

Rehabilitation of Motor Function after Stroke: A Multiple Systematic Review Focused on Techniques to Stimulate Upper Extremity Recovery

Samar M. Hatem[1,2,3], Geoffroy Saussez[2], Margaux della Faille[2], Vincent Prist[4], Xue Zhang[5], Delphine Dispa[2,6] and Yannick Bleyenheuft[2]*



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REHAB-1215; No. of Pages 6

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Review

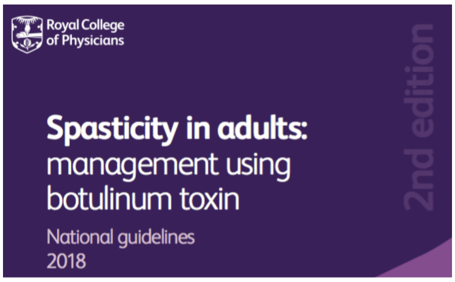
Adjuvant treatments associated with botulinum toxin injection for managing spasticity: An overview of the literature

Alessandro Picelli [a,b,*], Andrea Santamato [c], Elena Chemello [a], Nicoletta Cinone [c], Carlo Cisari [d], Marialuisa Gandolfi [a,b], Maurizio Ranieri [c], Nicola Smania [a,b], Alessio Baricich [d]

Take home messages -2

- Studies are needed to establish how changes in the neuronal component of spasticity interact longitudinally with the progressive biomechanical changes in different phenotypes after stroke or traumatic brain injury.
- Trials are needed in which the accompanying biomechanical changes, including muscle shortening and contractures, are prevented with botulinum toxin A injections at an early stage after brain injury.
- Third, the assumed association between reducing muscle tone and meaningful gains in task performance of the upper paretic limb is still poorly understood and seldom adequately investigated. Biomechanical and neurophysiological measurements, preferably done during meaningful tasks, are needed to investigate this association.

*Gert Kwakkel, Carel G M Meskers www.thelancet.com/neurology Vol 14 October 2015



3 BoNT-A injection	Grade of evidence	Strength
3.1 Patients should be selected for BoNT-A on the basis of: • focal or multi-focal problems due to spasticity • a dynamic spastic component as opposed to contracture • clearly identified goals for treatment and anticipated functional gains (taking into account the risks of any negative impact where patients rely on their spasticity for function).	E1 E2	Strong
2.4 BoNT-A injection must be part of a rehabilitation programme involving physical management and/or rehabilitation to achieve an optimal clinical effect.	RA E1 E2	Moderate

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