Managing tone and avoiding spasticity

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Background

• Disturbances in muscle tone are common after stroke
• Spasticity management after stroke identified as being of national interest in Scotland
• Stroke spasticity management unknown
• Are we doing well? Across the board?
• Can we do better?
Spasticity

“Spasticity is a motor disorder characterised by a velocity-dependent increase in tonic stretch reflexes with exaggerated tendon reflexes, resulting from hyperexcitability of the stretch reflex, as one component of the upper motor neurone syndrome”

(Lance 1980)

Consider:

hypotonus, rigidity, tremor, athetosis, spasm, clonus, ballism
Alternative definition

• Disordered sensorimotor control, resulting from an upper motor neurone lesion, presenting as intermittent or sustained involuntary activation of muscles

EUSPASM

Modified Ashworth Scale (MAS) of Muscle Spasticity

0  No increase in muscle tone
1  Slight increase in muscle tone manifested by a catch and release, or by minimal resistance through less than half the range of motion, when the affected part is moved in flexion or extension
1+ Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the range of movement
2  More marked increase in muscle tone throughout most of the range of movement, but affected parts move easily
3  Considerable increase in muscle tone, passive movement is difficult
4  Affected parts are rigid in flexion or extension

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Tardieu Scale

0  No resistance throughout the course of passive movement
1  Slight resistance throughout the course of passive movement with no clear catch at a precise angle
2  Clear catch at a precise angle interrupting passive movement followed by a release
3  Fatiguable clonus <10 seconds occurring at a precise angle
4  Fatiguable clonus >10 seconds occurring at a precise angle
Goal Attainment Scale (GAS)

-2 Much less than expected level of outcome
-1 Less than expected (starting level) level of outcome
0 Expected level of outcome
+1 Better than expected level of outcome
+2 Much better than expected level of outcome

This Goal Attainment Scale is used within NHS Greater Glasgow and Clyde with kind permission from Springer Science+Business Media B.V.
Spasticity in Stroke

- 19-43% develop spasticity
- 15% require pharmacological treatment
- 5% require botulinum toxin
  around 25 per 100k population

Cause of spasticity?

Current experimental evidence supports the theory that supraspinal origins of spasticity, likely arise from an imbalance between descending inhibitory and excitatory regulation of spinal stretch reflexes, secondary to cortical disinhibition after stroke.

(Sheng, Fransisco 2015, Sheng 2017)
Exacerbating (Trigger) Factors

Physical

Bowels
Bladder
Skin (pressure sores)
Injury
Nail problems
Systemic illness
Tight clothing or catheter bags
Medication changes
Seating/mattress changes

Emotional

Pain
Depression
Anxiety
Personal issues
Fear of falling
At a clinical level, there are two main contributing factors:

- neurogenic component: overactive muscle contraction
- biomechanical component: stiffening and shortening of the muscle and other soft tissues due to immobility
Contracture

A pathological condition of soft tissues characterised by stiffness and is usually associated with loss of elasticity and fixed shortening of the involved tissues (muscle, tendon, ligament, subcutaneous tissue, skin, blood vessels and nerves) and results in loss of movement around a joint.

1-2 weeks in animal models

Contracture

• 3 main factors leading to contractures in UMN lesions;
  Muscle weakness and paralysis
  Spasticity
  Immobilisation or immobility

• Need to consider number of structures when looking at contractures
  i.e. not just muscle involvement – joint capsule, ligaments and tendons also show changes
The Model of Disability that Forms the Basis for the International Classification of Functioning (ICF), Disability and Health (World Health Organization 2002)
### Table 3 Harmful effects of spasticity

<table>
<thead>
<tr>
<th>ICF level</th>
<th>Problem</th>
<th>Effect</th>
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<tbody>
<tr>
<td>Impairment</td>
<td>Muscle spasms</td>
<td>Pain</td>
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<td></td>
<td>Abnormal trunk and limb posture</td>
<td>Difficulty with seating and posture</td>
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<td>Fatigue</td>
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<td>Contractures</td>
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<td>Distress and low mood</td>
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<td>Poor sleep patterns</td>
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<td>Activity</td>
<td>Active function loss</td>
<td>Reduced mobility</td>
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<td>Inability to use limbs in function</td>
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<td>Passive function loss</td>
<td>Difficulty with sexual intercourse</td>
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<td>Difficulty with self-care and hygiene</td>
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<td>Increased carer burden</td>
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<td>Participation</td>
<td>Impact of any/all of the above</td>
<td>Poor self-esteem/self-image</td>
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<td>Reduced social interaction</td>
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<td>Impact on family relationships</td>
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Spasticity in adults: management using botulinum toxin RCP 2009 Management strategy for adults with spasticity. p5

Spasticity in adults: management using botulinum toxin RCP 2009 Management strategy for adults with spasticity. p13
National clinical guideline for stroke
Prepared by the Intercollegiate Stroke Working Party
Fifth Edition 2016
4.15 Recommendations

A People with motor weakness after stroke should be assessed for spasticity as a cause of pain, as a factor limiting activities or care, and as a risk factor for the development of contractures.

B People with stroke should be supported to set and monitor specific goals for interventions for spasticity using appropriate clinical measures for ease of care, pain and/or range of movement.

C People with spasticity after stroke should be monitored to determine the extent of the problem and the effect of simple measures to reduce spasticity e.g. positioning, passive movement, active movement (with monitoring of the range of movement and alteration in function) and/or pain control.

D People with persistent or progressive focal spasticity after stroke affecting one or two areas for whom a therapeutic goal can be identified (e.g. ease of care, pain) should be offered intramuscular botulinum toxin. This should be within a specialist multidisciplinary team and be accompanied by rehabilitation therapy and/or splinting or casting for up to 12 weeks after the injections. Goal attainment should be assessed 3-4 months after the injections and further treatment planned according to response.
4.15 Recommendations

E People with generalised or diffuse spasticity after stroke should be offered treatment with skeletal muscle relaxants (e.g. baclofen, tizanidine) and monitored for adverse effects, in particular sedation and increased weakness. Combinations of antispasticity drugs should only be initiated by healthcare professionals with specific expertise in managing spasticity.

F People with stroke should only receive intrathecal baclofen, intraneural phenol or similar interventions in the context of a specialist multidisciplinary spasticity service.

G People with stroke with increased tone that is reducing passive or active movement around a joint should have the range of passive joint movement assessed. They should only be offered splinting or casting following individualised assessment and with monitoring by appropriately skilled staff.

H People with stroke should not be routinely offered splinting for the arm and hand.
Common oral anti-spasticity agents

• Baclofen
• Benzodiazepines
• Dantrolene
• Tizanidine
• Gabapentin
Intramuscular toxin

- Botulinum toxin preparations (SMC license)
- Botox (Allergan) Upper and lower limb
  Dysport (Ipsen) Upper limb
  Xeomin (Merz) Upper limb
- Keeping pace with evidence?
- Changing skills mix? AHPs/nurses prescribing/injecting?
- Variation nationally IPTRs – treatment delays
- We need clarity/consensus on licensing, prescribing issues
- Scottish Government advice Deputy Chief Pharmacist
Scottish Context

- Questionnaire re spasticity management to MCNs Scotland wide 2015 through NACS
- Key stakeholders identified and invited to a SIP Workshop Stirling June 2016
- Review of evidence base/guidance
- Agreed protocols for ideal service pathways
- SIP RAG criteria developed and agreed
- STARs advancing module funded
- Authors recruited
Stroke Training and Awareness Resources (STARs)

- Module 19 - Spasticity Management
- SG Funded through SSCA/NACS
- Project Leads Mark Smith/Gill Alexander
- Project Manager Fran Bailey CHSS
- Launch September 2017 at Scottish Stroke Nurses Forum
- Case history based
- Use of video/interactives/quizzes etc.
Advancing Modules - #19

Labyrinth Modules (In Development)

STARS 19: Case study. Dave Walker
STARS 19: Conclusion
STARS 19: Introduction
STARS 19: Specialist spasticity services
STARS 19: Treatment
Brainstem Descending Systems

Medial

- Reticulospinal
- Vestibulospinal
- Coerulospinal/Raphespinal
- Tectospinal/Interstitiospinal

Lateral

- Corticospinal
- Rubrospinal
Systems controlling spinal reflexes

- Inhibitory
  - Lateral reticulospinal system

- Excitatory
  - Medial reticulospinal system
  - Lateral vestibulospinal system
Cortical tracts and spinal reflexes

You need to know some neuroanatomy to understand how the brain and spinal reflexes affect the muscles. If you want to look at or revise the descending tracts please click here for more information. (add additional information box or link this will be all the work from Debbie about the descending tracts)

The normal spinal reflexes and muscle contraction
Anatomy and Physiology of tone

At a clinical level, there are two main things to consider:

1. neurogenic component: overactive muscle contraction
2. biomechanical component: stiffening and shortening of the muscle and other soft tissues due to immobility.

- Reduction in the number of sarcomeres (atrophy)
- Decrease in overall length of sarcomeres (muscle becomes shorter)
- Relative increase in proportion of connective tissue (muscle becomes stiffer)

Muscles consist of contractile tissue and connective tissue
- Working mechanism of contractile tissue – myosin and actin myofilaments which interlock
- Units of the contractile tissue are sarcomeres which lie in series and form myofibrils
- Bundles of myofibrils form muscle fibres
- These fibres are held together to form fascicles which form the entire muscle
- Connective tissue surrounds and binds each
- This is made up of collagen & elastic fibers
POSITIONING FOR PEOPLE AFFECTED BY STROKE

This chart suggests possible positioning options for people affected by stroke. After a stroke, people can experience differing physical problems, and therefore careful positioning and placement of pillows can be made to achieve safe and comfortable postures for any individual.

Illustrations - Affected stroke side is in blue. Pictures do not depict bed rails.

LYING ON AFFECTED SIDE
• One or two pillows for head
• Affected shoulder positioned comfortably
• Place unaffected leg forward on one or two pillows
• Place pillow in front and behind

LYING ON UNAFFECTED SIDE
• One or two pillows for head
• Affected shoulder forward with arm supported on pillow
• Place affected leg backwards on one or two pillows
• Place a pillow behind.

SITTING UP
• Sitting well back in the chair or wheelchair
• Place arms well forward onto two pillows on table
• Feet flat on floor or footrests
• Knees directly above feet

LYING ON BACK (if desired)
• Place three pillows supporting both shoulders and head
• Place affected arm on pillow
• Optional pillow beneath affected hip
• Ensure feet in neutral position

SITTING IN BED
• Sitting in bed is desirable for short periods only
• Sitting upright well supported by pillows
• Place both arms on pillows
• Legs supported for comfort

CHSS takes no responsibility for the consequences of error, loss or damage suffered by users of information published on this chart.

Acknowledgement to
Mark Smith,
Clinical Specialist Physiotherapist for Stroke,
NHS Lothian.

If you require any more information please contact the Advice Line Nurses on:

0845 077 6000

Monday - Friday 9.30 - 12.30 and 1.30 - 4.00 (Local call rate)

www.chss.org.uk
Management of physical complications following stroke: Case 1: Mr McTavish

Examples of poor and good positioning in a chair

Poor positioning

This patient has a left-sided hemiplegia and is unable to maintain a good sitting position in his chair due to lack of support.

Specific points to note:

1. Hips - not central and too far forward in chair
2. Trunk - side flexed to the right
3. Head - orientated to the right with eye/gaze deviation to the right
4. Right upper limb - required to help patient maintain his balance
5. Left upper limb - increased tone
6. Left lower limb - increased extensor tone
Management of physical complications following stroke: Case 1: Mr McTavish

Example of good positioning in a chair

The following picture shows how careful positioning of the patient and the use of appropriate support (pillows in this case) can influence his alignment.

Specific points to note:

1. Hips - central and at the back of the chair
2. Trunk - supported with pillows to prevent side flexion to the right
3. Head - central and eyes looking ahead
4. Right upper limb - supported with pillows and no longer required for balance
5. Left upper limb - supported with pillows to help reduce tone
6. Feet flat on floor - positioning ankles, knees and hips at 90° will help reduce tone
Ankle Foot Orthoses (AFOs)
Wrist Hand Orthoses (WHO)
### 8.4 Spasticity Management RAG

<p>|   | Access to stroke spasticity management services | Stroke services should implement a documented programme for prevention and management, including self-management, of post stroke spasticity. All staff should have completed training on prevention and management of post stroke spasticity (STARs). Patients and carers should receive information on spasticity management both verbally and in written/online format. Timeous stroke spasticity services are available to all patients across the MCN area who require specialist assessment and intervention. | Mark Smith | No documented pathway or referral process for post stroke spasticity management is available, or plan in place to develop one. | RED | Plans in place to develop referral process or documented pathway for spasticity management, including staff training and patient/carer information | AMBER | Spasticity management pathway in place in some parts of the MCN area but approach is inconsistent. No specialist stroke spasticity services available. | GREEN | Spasticity referral process and documented pathway in place. Access to specialist, multidisciplinary spasticity services for some patients, but on an ad hoc basis throughout the MCN area. | COMPLETE | Spasticity referral process and documented management pathway in place. Timely specialist multidisciplinary stroke spasticity services, which include a specialist clinic and appropriate therapy follow up, are available across the entire MCN area. |</p>
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<th>Access to stroke spasticity management services</th>
<th>Self rated performance nationally by board in Scotland 2017</th>
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Acknowledgements

• Gill Alexander
• Niall Hughes
• Debbie Strang
• Susie Hughes
• Fran Bailey
Key References

  DB RCT 96 patients 6/12 post stroke reduced spasticity (MAS) increased function (GAS)

  RCT 333 patients >1/12 reduced spasticity not ARAT
Key References


RCT 163 patients > 1/12 reduced spasticity not FMAS

Key References

  DB RCT  273 patients reduced spasticity

  DB RCT >3/12 reduced spasticity
Key References


• Rosales, Raymond L ; Efendy, Fran ; Teleg, Ericka Sa ; Delos Santos, Mary Md ; Rosales, Mary Ce ; Ostrea, Marc ; Tanglao, Michelle J ; Ng, Arlene R., Botulinum toxin as early intervention for spasticity after stroke or non-progressive brain lesion: A meta-analysis.., Journal of the neurological sciences, 15 December 2016, Vol.371, pp.6-14
Thank you

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