**Appendices**

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| Common Features of Hypertonia  |
| Spasticity - hyperactive stretch reflex |
| Dystonia |
| Rigidity |
| Abnormal posturing of limbs extensor/flexor |
| Associated reactions |
| Stereotyped movement synergies |
| Biomechanical changes |
| Clonus |

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| Triggers | Possible Intervention | References |
| Medical Management/Nursing |
| Co-morbidities | * Optimise management of pre-existing conditions
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| Bladder and Bowel(catheter care, constipation, loose stools, urinary retention, neurogenic bladder) | * Bladder scan to rule out retention
* Regular catheter care
* Bowel regimes monitoring
* Treatment of constipation or bladder retention
* Regular pad changes
* Consider convenes
* Optimise self-management of bowel and bladder.
 | * Coggrave M, Norton C, Wilson-Barnett J (2009) **Management of neurogenic bowel dysfunction in the community.** Spinal Cord. 47: pp.323- 330.
* Coloplast. (2012) **Guidelines for the management for neurogenic bowel dysfunction in individuals with central neurological conditions.** <http://www.southportandormskirk.nhs.uk/spinal/pdfs/Neurogenic%20Bowel%20dysfunction%20guidelines.pdf>
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* Fowler K, Panicker J, Emmanuel A. (2010) **Pelvic Organ dysfunction in neurological disease: clinical management and rehabilitation.** Cambridge University Press.
* Lough J, Cowan, P (2015) **Spasticity Triggers.** MS Trust ( Reviewed every 3 years) <https://support.mstrust.org.uk/shop?prodid=400>
* MASCIP (2012) **Guidelines for management of neurogenic bowel dysfunction in individuals with central neurological conditions.** Multidisciplinary Association of Spinal Cord Injury Professionals. Consensus document. MASCIP
* NICE. (August 2012) **Urinary incontinence in neurological disease: assessment and management.** NICE Guideline. CG 148.
* Panicker J, Fowler CJ, Kessler, T ( July 2015) **Lower urinary tract dysfunction in the neurological patient: clinical assessment and management.** The Lancet. Neurology. 14 (7) pp.720-732
* Phadke CP, Balasubramanian CK , Ismail F , Boulias C. (April 2013) **Revisiting physiologic and psychologic triggers that increase spasticity.** American Journal of Physical medicine and rehabilitation. 92 (4) pp.357-69
 |
| Infections(chest, urinary tract infection, infected wounds, CNS infections, viral infections) | * Regular observations
* Septic screening
* Bloods and treatment as appropriate
 | * British Society of Rehabilitation Medicine. **BSRM Standards for Rehabilitation Services, Mapped on to the National Service Framework for Long-Term Conditions**. BSRM, London 2009.
 |
| Paroxysmal Sympathetic Hyperactivity(sweating, tachypnoeic, tachycardic, bradycardia, pyrexia, hypertension, dystonic posturing) | * Medical management to optimise
 | * Perkes I, Baguley I, Nott M and Menon D (2010) **A review of paroxysmal sympathetic hyperactivity after acquired brain injury**. Annals of neurology. 68: pp.126–135.
* Baguley I, Perkes I, Fernandez-Ortega J, Rabinstein A, Dolce G and Hendricks, H (2014) **Paroxysmal Sympathetic Hyperactivity after Acquired Brain Injury: Consensus on Conceptual Definition, Nomenclature, and Diagnostic Criteria**. Journal of neurotrauma. 31: pp1515–1520.
* Choi A, Jeon S, Samuel S, Allison T, Lee K (2013) **Paroxysmal sympathetic hyperactivity after acute brain injury**. Current neurology of neuroscience. 13(8):370.
 |
| Medication(timing, administration, lack of analgesia) | * Consider lack of analgesia
* Consider type of pain ie MSK, neuropathic and appropriate
* Consider side effects from other medications
* Consider 24 hour pattern of symptoms
* Adjust dosage/timing
 | * Walton, K. (2003) **Management of Patients with Spasticity: A practical approach**. Practical Neurology. 3 (6) pp.342-353
* Kheder M, Nair K. (2012) **Spasticity: pathophysiology, evaluation and management**. Practical Neurology. 12: 289-298
* Martins, M. (2016) **The Role of Spasticity in Functional Neurorehabilitation-Part II: Nonpharmacological and Pharmacological Management: A Multidisciplinary Approach.** Archives of Medicine. 8: 3:8
 |
| Hydration/Nutrition(dehydration, over-hydration, vomiting, gastrostomy/nasogastric tube care) | * Consider dehydration
* Over-hydration
* Vomiting
* Gastrostomy/nasogastric tube care
* Management of these symptoms
 | * Anderson PM et al. **EFNS guidelines on the clinical management of ALS-revised report of an EFNS task force.**
* Clasey JL, Gater DR. (2007) **Body composition assessment in adults with Spinal Cord Injury**. Topics in Spinal Cord Injury Rehabilitation. 12(4)
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* Jahromi,SR et al. (2014) Islamic **Fasting and Multiple Sclerosis**. BMC Neurology. 14(1)
* Little JW et al. (2000) **Neurologic Recovery and neurologic decline after Spinal Cord Injury.** Physical Medicine and Rehabilitation Clinics of North America. 11(1) pp.73-89
* Murphy MP, Carmine H. (2012) **Long term health implications of individuals with TBI: A Rehabilitation Perspective**. Neurorehabilitation. 31(1) pp. 85-94
* Santos MT et al. (2011) **Oral motor performance in spastic Cerebral Palsy individuals-Are hydration and nutritional status associated?** Journal of Oral Pathology & Medicine.
* Simmons Z. (2005) **Management strategies for patients with Amyotrophic Lateral Sclerosis from diagnosis through death**. Neurologist, 11(5) pp.257-270
* Stamate, T, Budurc, AR. (2005) **The treatment of sacral pressure sores in patients with spinal lesions.** Acta neurochirurgica. Supplement. 93: pp.183-187
 |
| Tracheostomy | * Optimising chest
* Stoma management
* Minimise aspiration risk
* Check humidification
 | * 7 Guidelines for the Care of Patients with Tracheostomy Tubes, St Georges Healthcare NHS Trust. 2012 Edition. Located on the RCP database.
* **Standards for the care of adult patients with a temporary tracheostomy** : STANDARDS AND GUIDELINES, Intensive Care Society - ICS - 12 June 2014 - Publisher: Intensive Care Society. Located on <https://www.evidence.nhs.uk/search?q=Tracheostomy+guidelines>
 |
| Secretion and Salivary Management | * Hyoscine patches
* Glycopyrrolate
* Atropine
* Mouth Care
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| Heterotopic Ossification | * Scans
* Medical management
* Consider handling
* Consider stopping passive stretches.
 |  |
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| Environmental / Overstimulation  |
| Room Temperature(hot, cold, poor positioning of fans) | * Hot
* Cold
* Poor positioning of fans
* Direction of sunlight
 | Pryor J. (2004) **What environmental factors irritate people with acquired brain injury?** Disability and Rehabilitation. 26 (16): 974-980 |
| External Noise(tv, radio, visitors, other patients) | * TV
* Radio
* Visitors
* Other patients
* Monitoring
* Consider side room if available
 | Pryor J. (2004) **What environmental factors irritate people with acquired brain injury?** Disability and Rehabilitation. 26 (16): 974-980 |
| Lighting(brightness) | * Too bright
* Too dark
 | Pryor J. (2004) **What environmental factors irritate people with acquired brain injury?** Disability and Rehabilitation. 26 (16): 974-980 |
| Soiled Bedding/Garments | * Regular changes
* Good continence care
 | Pryor J. (2004) **What environmental factors irritate people with acquired brain injury?** Disability and Rehabilitation. 26 (16): 974-980 |
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| Cognitive / Psychological / Behavioural |
| Perceptual(inattention, body schema) | * Consider external environment
* Consider Room Layout
* Increase sensory and proprioceptive feedback
* Liaise with OT and Psychology
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| * Corrigan JD, Mysiw WJ, Gribble M, Chock S (1992). **Agitation, cognition and attention during post-traumatic amnesia**. Brain Injury; 6 155 - 160
 |

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| Insight into Condition (lack of insight, risk taking, good insight can cause distress) | * Liaise with OT and Psychology
* Build insight through verbal and visual queuing
 |  |
| Disorientated(to environment) | * Orientation charts
* Prompts
* Liaise with OT and Psychology
 |  |
| Memory(forgetting advice)  | * Liaise with OT and Psychology
* Repetition
* Diaries
* Visual information
 |  |
| Anxiety / Fear (of movement, other patients, future, handling, changes to routine) | * Liaise with Psychology
* Clear instructions
* Reassurance
* Patient led sessions
* Consider tone of voice
* Consider visual/ perception/ disorientation disturbance
 |  |
| Relationship Stress (carer, changing role, partner, children) | * Liaise with Psychology
* Consider timing of visitors
 |  |
| Behavioural (impulsivity, risk taking, sexual disinhibition) | * Build routine
* Liaise with Psychology and OT
 | * Alderman N. (2003). **Contemporary approaches to the management of irritability and aggression following traumatic brain injury**. Neuropsychological Rehabilitation; 13: 211 – 240.
* Gervasio AH and Matthies BK (1995). **Behavioural management of agitation in the traumatically brain injured person**. Neurorehabilitation; 5 309 – 316.
 |
| Fatigue | * 24 hour fatigue management plan
* Monitor sleep wake cycle
* Reduce over stimulation
 |  |
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| Physical |
| Pain  | * Liaise with Physio
* Analgesia (MSK or neuropathic, nerve blocks if shoulder pain, steroid injections)
 | * Smania N, Picelli, A, Munari D, Geroin C, Ianes P, Waldner A, Gandolfi M. (2010) **Rehab Procedures in the Management of Spasticity.** European Journal of Physical and Rehab Medicine.46: p423-438
 |
| Oedema  | * Elevation
* Positioning
* Taping
* Oedema massage
* K-Tape
* Lycra
* IPC Boots
 | * CLOTS (Clots in Legs Or sTockings after Stroke) Trials Collaboration (2013) **Effectiveness of intermittent pneumatic compression in reduction of risk of deep vein thrombosis in patients who have had a stroke (CLOTS 3): a multicentre randomised controlled trial.** Lancet 382: 516–24.
* Gracies JM, Marosszeky JE, Renton R, Sandanam J, Gandevia SC, Burke D. (2000) **Short-Term effects of dynamic lycra splints on upper limb in hemiplegic patients.** Archives of Physical Medicine and Rehabilitation 81(12):1547-55.
* Huang YC, Chang KH, Liou TH, Cheng CW, Lin LF, Huang SW. (2017) **Effects of Kinesio taping for stroke patients with hemiplegic shoulder pain: A double-blind, randomized, placebo-controlled study.** Journal of rehabilitation medicine. 6:49 (3):208-215.
* Jaraczewska E, Long C. (2006) **Kinesio taping in stroke: improving functional use of the upper extremity in hemiplegia.** Topics in stroke rehabilitation. 13(3):31-42.
* NICE, CG 92 (2015). **Venous thromboembolism: reducing the risk for patients in hospital.**
* Watson MJ, Crosby P, Matthews M. (2007) **An evaluation of the effects of a dynamic lycra orthosis on arm function in a late stage patient with acquired brain injury**. Brain Injury 21(7):753-61.
* Woldag H, Hummelsheim H. (2002) **Evidenced based physiotheraputic concepts for improving arm and hand function in stroke patients: a review** 249(5): 518-28.
 |
| Pressure Care (mattress, pre-existing sores, splints/orthoses, skin integrity, tight clothing, attachments, continence management) | * Liaise with nursing team
* Liaise with tissue viability
* Gel pads
* Pressure cushions and chairs
* Foot and hand care
 | * Farley R, Clark J, Davidson C, Evans G, Maclennan K, Michael S, et al. **What is the evidence for the effectiveness of postural management?** Br J Ther Rehabil. 2003;10(10):449–55
* The National Institute for Health and Care Excellence. **Pressure ulcers: prevention and management**. NICE clinical guideline CG179. 2014.
* Gillespie BM, Chaboyer W., McInnes E, Kent B, Whitty JA, Thalib L. **Repositioning for pressure ulcer prevention in adults (**Review). Cochrane Database Syst Rev. 2014;(4):1–42.
 |
| Lack of Postural Control (increased effort, challenging against gravity, associated reactions) | * Liaise with Physio and OT
* Postural management
* Increase support
* Sleep systems
* Medical management of cough, sneeze, itch and vomit
* Specialist seating
* Wheelchairs
 | * Jacobs JV, Horak FB. (2007) **Cortical control of postural responses**. Journal of neural transmission.
* Geuts AC, deHaart M, van Nes IJ, Duysens J. (2005) **A review of standing balance recovery from stroke.** Gait and Posture 22 (3):267-81.
* Holland A, Lynch-Ellerington M (2009) **The control of locomotion**. In Raine S, Meadows L, Lynch-Ellerington M. Bobath Concept: Theory and clnical Practice in Neurological Rehabilitation. Oxford, Wiley-Blackwell.
* Kleim J, Jones T (2008) **Neural plasticity: Implications for rehabilitation after brain damage**. Journal of Speech Language and Hearing Research 51:S225-S239.
* Santos MJ, Kanekar N, Aruin AS. (2010) **The role of anticipatory postural adjustments in compensatory control of posture: 1. Electomyographic analysis**. Journal of Electromyography and Kinesiology 20:388-397.
* Santos MJ, Kanekar N, Aruin AS. (2010) **The role of anticipatory postural adjustments in compensatory control of posture: 2. Biomechanical analysis**. Journal of Electromyography and Kinesiology 20:398-405.
* Sousa AS, Silva A, Tavares JM. (2012) **Biomechanical and neurological mechanisms related to postural control and efficiency of movement: a review**. Somatosensory and Motor Research. 29 (4):131-43.
* Urquhart DM, Hodges PW, Story IH. (2005) **Postural activity of the abdominal muscles varies between regions of these muscles and between body positions**. Gait and Posture 22 (4):295-301.
* Whelan PJ (2009) **The involvement of the motor cortex in postural control: a delicate balancing act.** The journal of physiology.
 |
| Fatigue(physical, sleep cycle) | * 24 hour fatigue management plan
* Review sleep cycle
 |  |
| Positioning (in bed, seating, lack of support, lack of sensory feedback, pressure relief) | * In bed/seating
* Lack of support
* Lack of sensory feedback
* 24 hour positioning
* Education
* Pressure Care
 | * Maravita M, Spence C, Driver J. (2003) **Multisensory intergreation and the body schema: close to hand and within reach.** Current Biology 13:531-9.
* Rothwell JC, Rosenkranz K. (2005) **Role of afferent input in motor organisation in health and disease**, IEEE Engineering in Medicine and Biology 24:40-44.
* RCP (2003) **Rehabilitation following Acquired Brain Injury.** National clinical guidelines.
* RCP (2016) **National Clinical Guideline for Stroke**, 5th Ed. Sub section 4.15 pg 83.
* Graham LA (2013) **Management of spasticity revisited**, Age and Ageing 42(4): 435-441.**Laura A. Graham**, , ,
 |
| Moving and Handling (confidence, poor handling) | * Education of family and carers
* Joint session where required
* Clear communication with patient throughout
* Re-education of movement
* Transfers
* Aids
 |  |
| Sensory Deficits(hypersensitivity, hyposensitivity, proprioceptive loss, sensory inattention) | * Lycra
* Sensory stimulation programs
* Positioning to increase sensory feedback and appropriate body schema
* Tactile stimulation
 | * Smania N, Picelli A, Munari D, et al. (2010) **Rehabilitation procedures in the management of spasticity**. Eur J Phys Rehabil Med. 46:423-38.
* Yelnik AP, Simon O, Parratte B, et al. (2010) **How to clinically assess and treat muscle overactivity in spastic paresis**. J Rehabil Med 2010;42:801-7.
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| Outcome Measures used in Hypertonia  |
| You may find the below sites useful:* <https://www.sralab.org/rehabilitation-measures>
* <https://www.strokengine.ca/en/>
* <https://www.kcl.ac.uk/nursing/departments/cicelysaunders/attachments/Arm-A-Questionnaire.pdf>
* <https://www.kcl.ac.uk/nursing/departments/cicelysaunders/attachments/LEGA.pdf>
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