**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 |  |
| 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> * Glickman S, Kamm MA. (1996) **Bowel dysfunction in spinal cord injured patients**. Lancet. 347 pp.1651-1653. * Graham, L. (2013) **Management of spasticity revisited.** Age and Ageing. 42 (4) pp.435-441 * Green, D (2013) **Neurogenic bowel dysfunction**. SCI-elearn.org. Online education module. ISCOS. * 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) * Hawker KS, Frohman EM. (2001) **Bladder, Bowel and Sexual Dysfunction in Multiple Sclerosis**. Current treatment options in Neurology, 3(3) pp.207-214 * 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 |  |
| 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 | |  | | --- | | * Corrigan JD, Mysiw WJ, Gribble M, Chock S (1992). **Agitation, cognition and attention during post-traumatic amnesia**. Brain Injury; 6 155 - 160 | |
| 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> |