

ABIKUS Evidence Based
Recommendations for
Rehabilitation of Moderate to
Severe Acquired Brain Injury
(2007)



ABIKUS

Acquired Brain Injury Knowledge Uptake Strategy

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NOTE FOR USERS OF THE GUIDELINE

SCOPE AND PURPOSE

The Acquired Brain Injury Knowledge Uptake Strategy (ABIKUS) Guideline was designed to provide evidence based recommendations for rehabilitation of persons with moderate and severe Acquired Brain Injury (ABI) in the post acute period. The recommendations apply to all age groups unless otherwise stated.

TARGET USERS

The primary users of the ABIKUS Guideline will be healthcare professionals. However, the ABIKUS Guideline may also be used by stakeholders (policy makers, funding bodies), rehabilitation support workers who provide rehabilitation care for acquired brain injury patients and persons with brain injury and their families. Ultimately this should assist clinicians to provide the most effective treatment based on the current best evidence. These recommendations are intended to serve as a guide for providers, and clinical discretion should be used by all who are following the ABIKUS EBR (Evidence Based Recommendations).

TARGET POPULATION

The target population these recommendations are developed for are persons with moderate and severe ABI. In most instances, these will be people with traumatic brain injury, however, the recommendations may be applicable to other forms of ABI as noted in particular recommendations.

ABIKUS RECOMMENDATIONS

The ABIKUS Guideline are a result of a thorough search, review, and critical evaluation of currently published Clinical Practice Guidelines (CPGs) by a panel of experts including: ABI rehabilitation researchers, clinicians and stakeholders. The goal was not to create new recommendations, but to select from currently published, high quality CPG those recommendations most clinically relevant for health care in Canada. The phrasing of many of the recommendations has been modified slightly to achieve standardized terminology or to make the recommendation more specific. Care was taken to not change the context for which the original recommendation was written. Additional recommendations made by the ABIKUS panel that went beyond the original context have been referenced with the term ABIKUS and with the appropriate level of evidence. As various systems for determining the level of evidence were used across the CPGs, the ABIKUS team standardized this by using the system outlined below.

Table 1: ABIKUS Levels of Evidence

ABIKUS Levels of Evidence	
A	At least one randomized controlled trial, meta-analysis, or systematic review.
B	At least one cohort comparison, case studies or other type of experimental study.
C	Expert opinion, experience of a consensus panel.
NE	No evidence provided.

REVIEW OF THE GUIDELINE

This Guideline was issued in September, 2007 and will be reviewed in 2009 or sooner if new evidence becomes available. Comments are invited to assist the review process. All correspondence and comments regarding the recommendations in this Guideline should be sent to:

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BACKGROUND

The objectives of the Acquire Brain Injury Knowledge Uptake Strategy (ABIKUS) project were to: (i) Identify research gaps in ABI rehabilitation; and (ii) Identify areas for knowledge translation or mobilization in ABI rehabilitation.

In the Fall of 2006, the ABIKUS project team held a consensus conference to identify the top five research gaps in ABI rehabilitation, prioritize key areas of knowledge translation, and develop priorities for EBR for implementation. The top five research gaps for ABI rehabilitation was derived using an open voting process and small group discussions and included:

- 1) What is the optimal timing, intensity, and duration of brain injury rehabilitation?
- 2) Which models of rehabilitation result in the best ultimate outcomes?
- 3) What are the ideal strategies to promote community reintegration?
- 4) Which behavioral strategies result in the best outcomes?
- 5) Which strategies promote optimal emotional adaptation to brain injury related changes?

The priority areas for implementation of best practice were identified using an open voting process and summary discussion method. The panel determined that the following ABI rehabilitation areas had the strongest evidence and were suitable for development of evidence-informed best practice recommendations:

1. Principles of ABI rehabilitation
2. Promotion of brain injury awareness through professional education
3. Recognition and screening for complications of brain injury

ABIKUS GUIDELINE DEVELOPMENT PROCESS

The Guidelines Adaptation Cycle process by Graham & Harrison (2005) was used to develop the ABIKUS guideline. As suggested in this model, to minimize repetition of previously completed work, the ABIKUS project leaders first reviewed existing ABI guideline and adapted these to Canadian needs.

Clinical Practice Guideline Search Strategy

A comprehensive search using OVID (MEDLINE, CINAHL, PsychINFO) was conducted to identify previously published guidelines for the management of acquired brain injury rehabilitation and risk assessment for depression, dysphagia, heterotopic ossification, Deep Vein Thrombosis (DVT), and seizure. Search was limited to the years 1999 to 2006. Articles related to ABI rehabilitation clinical practice guidelines were obtained and their reference list were reviewed to identify additional sources. Additionally, the Internet was used to conduct a general web search and known web sites were searched for ABI rehabilitation guidelines published within the past 7 years. The following key words were used alone and in combination for both the OVID and Internet searches: *brain injuries, head injuries, traumatic brain injury, guidelines, practice guidelines, and best practice*. All CPGs were considered for inclusion if they were published in English or French in the last seven years, by more than one author and cited scientific evidence for the recommendations. Excluded were guidelines on pre-hospital or early management, mild head injury, including sport related concussions, those that focused on neuroimaging only and also expert opinion guidelines were excluded. For those guidelines reported in several different articles, the one with the most detailed description of the guideline was selected.

Eleven citations were retrieved in MEDLINE, three in CINAHL and one in PsycINFO. By reviewing the reference lists, we identified five additional guidelines. The internet based search revealed 11 additional guidelines. Of the 31 guidelines retrieved, 10 met the inclusion criteria. The 10 clinical practice guidelines that met our inclusion criteria for acquired brain injury rehabilitation are listed in Table 2.

Group	Guideline Title	Year
Brain Trauma Foundation (BTF)	Guidelines for the Management of Severe Traumatic Brain Injury	2000
Scottish Intercollegiate Guidelines Network (SIGN)	Early Management of Patients with a Head Injury (Publication # 46)	2000
Scottish Head Injury Forum (SHIF)	Service Standards for The Rehabilitation of Adults with Acquired Brain Injury	2001
National Institute for Clinical Excellence (NICE)	Head Injury: Triage, Assessment, Investigation and Early Management of Head Injury in Infants, Children and Adult	2003
Pediatric Critical Care Medicine (found in the Brain Trauma Foundation)	Guidelines for the Acute Medical Management of Severe Traumatic Brain Injury in Infants, Children and Adolescents	2003
Royal College of Physician (RCP)	Rehabilitation Following Acquired Brain Injury	2003
Cicerone et al.	Evidence-Based Cognitive Rehabilitation: Updated Review of the Literature From 1998 Through 2002	2005
Neuro Trauma Foundation (NTF)	Guidelines for the Pharmacologic Treatment of Neurobehavioral Sequelae of Traumatic Brain Injury	2006
Ontario Brain Injury Neurobehavioral Network (OBINN)	Standards for Behavioral Intervention for Persons with an Acquired Brain Injury	2006
The New Zealand Guidelines Group (NZG)	Traumatic Brain Injury: Diagnosis, Acute Management and Rehabilitation Guidelines	2006

Table 2: Clinical Practice guidelines evaluated for ABIKUS Guideline

Recommendations Matrix

A table, the recommendations matrix, was created to simplify comparison of the specific CPG recommendations made by each existing guideline in terms of the level of evidence supporting each recommendation. All recommendations relevant to rehabilitation of brain injured patients were categorized and then included in the recommendation matrix. The level of evidence used by each of the guidelines varied depending on individual methodology followed. All levels of evidence were reclassified according to table 1 for easy comparison in the recommendation matrix

Quality Assessment Using the AGREE Instrument

Prior to the Expert Consensus Conference, each CPG was allocated to four or five expert panel members for appraisal of the guideline development process and quality of the guideline. This was done using the Appraisal of Guidelines for Research and Evaluation (AGREE) instrument (www.agreecollaboration.org). The AGREE instrument assess the quality of CPG across 6 domains including: (1) Scope and purpose, (2) Stakeholder involvement, (3) Rigour of development, (4) Clarity of presentation, (5) Applicability, and (6) Editorial independence. Each guideline was given a standardized score ranging from 1-100 (100 representing a strong score) by the reviewing expert. The AGREE scores were summarized and presented to the expert panels at the conference in January 2007.

ABIKUS GUIDELINE

Part I

1. General Principles for Organization of Rehabilitation Services
2. Early Assessment, Treatment and Care
3. Principles of Use of Medications in Persons with Brain Injury
4. Behavioral Rehabilitation
5. Cognitive Rehabilitation
6. Communication Rehabilitation
7. Rehabilitation of Motor Function and Control
8. Sensory Impairment
9. Optimizing Performance in Daily Living Tasks

Part II

10. Assessment and Management of Complications

Part III

11. Discharge Planning
12. Community Reintegration
13. Family and Caregivers
14. Brain Injury Awareness and Education

KEY TO LEVELS OF EVIDENCE OF RECOMMENDATIONS

ABIKUS Levels of Evidence	
A	At least one randomized controlled trial, meta-analysis, or systematic review.
B	At least one cohort comparison, case studies or other type of experimental study.
C	Expert opinion, experience of a consensus panel.
NE	No evidence provided.

ABBREVIATIONS USED IN GUIDELINE RECOMMENDATIONS

ABI	Acquired Brain Injury
BTF	Brain Trauma Foundation
NICE	National Institute for Clinical Excellence
NTF	Neuro Trauma Foundation
NZG	The New Zealand Guidelines Group
OBINN	Ontario Brain Injury Neurobehavioral Network
RCP	Royal College of Physician
SIGN	Scottish Intercollegiate Guidelines Network
TBI	Traumatic Brain Injury

G Guideline Recommendation



Pediatric/Children Recommendation

PART I

1. GENERAL PRINCIPLES FOR ORGANIZATION OF REHABILITATION SERVICES

Effective management of the brain-injured patient often involves the services of a multidisciplinary team of health care professionals. A well-organised support service that will provide a full range of rehabilitation, enhancement of coping skills, and psychological support that an individual and their family/caregivers may need at different stages following brain injury is important.

- G1** Care should follow a client centered approach responding to the needs and choices of persons with moderate to severe Acquired Brain Injury (ABI) as they evolve over time. (ABIKUS C)
- G2** Every patient with a moderate to severe acquired brain injury should have access to timely specialized interdisciplinary rehabilitation services. (ABIKUS C)
- G3** Service providers for persons with moderate to severe ABI should be given specialized training to develop competencies in evaluation and management related to moderate to severe ABI. This should be provided on an ongoing basis. (ABIKUS C, adapted from SIGN,10, p. 26)
- G4** Within and between service networks, there should be a case management or equivalent system, which gives persons with brain injuries and their family/caregivers an identifiable guide and advocate (navigator) through the continuum of care. (ABIKUS C)
- G5** Interdisciplinary protocols or integrated care pathways should be in place for management of common problems. (A, adapted from RCP G22, p. 21)

2. EARLY ASSESSMENT, TREATMENT AND CARE

The objective of these recommendations is to optimize a patient's medical condition in acute care and thus improve and/or speed up recovery.

- G6** The management of head injured patients should be guided by clinical assessments and protocols based on the Glasgow Coma Scale score. The adult and pediatric versions of the Glasgow Coma Scale should be used to assess people. (B, adapted from SIGN, 2.1, p.3)

G7 People who have had a traumatic brain injury should be assessed for functional deficits in activities of daily living and be assessed for specific impairments in: control over bowels and bladder, speech and swallowing, motor control, sensory function, language production and comprehension, cognition and memory behaviour and emotion, potential medical and psychiatric comorbidities, which have symptomatic overlap with traumatic brain injury. (B, adapted from RCP, G28, p.22)



The Glasgow Coma Scale (GCS) is difficult to apply to the young (under 5 years) child. Although modifications exist, great care needs to be taken with its interpretation and this should be done by those with experience in the management of the young child. The pediatric version of the GCS should include a 'grimace' alternative to the verbal score to facilitate scoring in pre-verbal or intubated patients. (C, adapted from SIGN, 2.1, p.3)

2.1. IMAGING

G8 The current investigation of choice for the detection of acute clinically important brain injuries is Computed Tomography (CT) imaging of the head. (ABIKUS A)

G9 CT scans should be immediately requested for adults who have sustained a head injury, if they have any one of the following factors:

- ◆ Any deterioration in condition
- ◆ A GCS score of less than 13 when assessed, irrespective of the time elapsed since the injury
- ◆ A GCS score of 13 or 14 two hours after injury
- ◆ A suspected open or depressed skull fracture
- ◆ Any sign of basal skull fracture (haemotympanum, panda eyes, cerebrospinal fluid, otorrhoea, Battle's sign)
- ◆ Post-traumatic seizure
- ◆ Focal neurological deficit
- ◆ Vomiting after trauma
- ◆ Amnesia for greater than 30 minutes of event before impact
- ◆ Age 65 years or older
- ◆ Coagulopathy (history of bleeding, clotting, disorder, current treatment with warfarin)
- ◆ High-risk mechanism of injury
- ◆ New onset severe and persistent headache

(B, adapted from SIGN, 5.3, p.10)



CT scans are recommended for children in the case of all of the above and when a scalp hematoma is present in patients less than 2 years old. (ABIKUS B)

3. PRINCIPLES OF USE OF MEDICATIONS IN PERSONS WITH BRAIN INJURY (NEUROPHARMACOLOGY)

This section provides the principles of use of medications after brain injury. For recommendations regarding specific medications please review the relevant post brain injury problem (i.e. please look in the section on Cognitive Rehabilitation for medications that may be helpful for cognitive problems).

- G10** There should be careful consideration of the sensitivity of people with traumatic brain injury to psychotropic medication before trial use. Psychotropic medication should be used with caution. Where medications are clinically indicated 'start low and go slow', keep under direct clinical monitoring to ensure that the drug is tolerated and producing the expected improvement and used with caution where indicated. (ABIKUS C, adapted from NZG, 14.4.10.3, 182)
- G11** Perform a detailed physical exam prior to commencing any trial of medications. People with traumatic brain injury and their caregiver should be asked about any prescribed medications, over the counter remedies, herbs or supplements they are taking to check for potential interactions and adverse effects. (ABIKUS C)
- G12** Appropriate investigations should be completed prior to medication trials to rule out and minimize metabolic abnormalities including evaluation of: plasma blood sugar, electrolytes, hormones, hemoglobin, oxygenation and infection. (ABIKUS B)
- G13** Clinicians should also consider the possibility of brain injury related sleep disorders as a cause of cognitive and other behavioural changes. (ABIKUS B, adapted from Mahmood et al., 2004)
- G14** Any trial of medication for a person with traumatic brain injury should be preceded by a clear explanation to the person with traumatic brain injury and their caregivers, and a caution that effects of medications are less predictable in people with traumatic brain injury. (ABIKUS C)

3.1 MEDICATION MANAGEMENT OF EARLY POST TRAUMATIC AGITATION AND POST TRAUMATIC AMNESIA

The clinician is advised to consider the other effects of medications in selecting medication for treatment of agitation in the acute phase. There is no medication that has been shown to be effective in all persons with brain injury.

G15 Minimize use of Benzodiazepines and Neuroleptic antipsychotic medications as animal studies suggest these medications may slow recovery after brain injury. (ABIKUS C)

Beta Blockers:

G16 Beta Blockers are recommended as a guideline for the treatment of aggression after TBI. Studies reported the efficacy of both Propranolol (maximum dose 420-520 mg/day) and Pindolol (maximum dose 40-100 mg/day) in the treatment of aggression in this population. (ABIKUS A, adapted from GPT 1 p.1482)

Anticonvulsants:

G17 Carbamazepine and/or Valproic Acid may be used to decrease the incidence of aggressive behaviours. (ABIKUS B)

G18 Valproic Acid may be preferred over Phenytoin post brain injury as it does not have any significant neuropsychological side effects, and is effective for controlling established seizures and stabilizing mood. (ABIKUS B)

4. BEHAVIORAL REHABILITATION

G19 People with brain injury and severe behavioural problems should be provided with access to specialized psychological assessments and behavioural management services and interventions to assist in the management of their behavioural difficulties, including substance abuse. (ABIKUS C)

G20 Staff should be trained in specific behavioural change strategies, especially in understanding of brain-behaviour relationships, and these should be applied consistently. (ABIKUS C)

G21 Patients should be given information, advice and the opportunity to talk about the impact of brain injury on their lives with someone experienced in managing the emotional impact of acquired brain injury. (ABIKUS C, adapted from RCP, G127, p. 45)

- G22** Behavioural Assessment data must identify possible or probable cause/function of targeted behaviour. The relationship of environmental triggers, and reinforcing events to the occurrence of both target behaviours and adaptive alternatives must be described. (ABIKUS B, adapted from OBINN, 14, p.15)
- G23** When necessary, an assessment by a medical specialist (e.g. neuropsychiatrist, behavioural neurologist, physiatrist or pediatric neurologist) should be made to differentiate neurobehavioral difficulties from symptoms of a functional illness (e.g. seizures, mood, anxiety disorders, personality disorders, metabolic disorders, and medication adverse effects). (ABIKUS C, adapted from NZG, 6.1.7, p. 104)
- G24** Any behavioural management plan must include a consideration of the precipitating factors or triggers possibly leading to the behaviour. (ABIKUS B)
- G25** Any organization or individual caregiver providing service to individuals with brain injury should have a crisis prevention plan as well as a policy in effect. (ABIKUS C)
- G26** Any restrictive interventions (e.g. restraints) must be subject to professional and administrative review and approval in accordance with professional practice guidelines, legislation and organizational policies. (ABIKUS C)

4.1 PHARMACOLOGICAL MANAGEMENT OF EPISODIC BEHAVIOURAL OR EMOTIONAL DYSCONTROL AFTER EMERGENCY FROM POST TRAUMATIC AMNESIA

Anticonvulsants:

- G27** Valproic Acid and Divalproex may be used (in usual anticonvulsant dosages) to reduce neurobehavioural symptoms including destructive and aggressive behaviours. This medication may be particularly useful in those people with concurrent seizure disorders. (ABIKUS B)

Methylphenidate:

- G28** Treatment with Methylphenidate following brain injury may be considered in persons with brain injury to reduce anger as measured using several anger outcome measures (particularly if they have deficits in attention and concentration). (ABIKUS B)

Serotonin Reuptake Inhibitors:

- G29** Selective Serotonin Reuptake Inhibitors (SSRIs) are recommended at the option level for the treatment of aggression following TBI. Specifically, Sertraline (25-200 mg/day) and Paroxetine (20 mg/day) have been reported to be effective for the treatment of aggression in this population. (ABIKUS B, adapted from GPT, I, p.1492)

Beta Blockers:

- G30** Beta Blockers are recommended as a guideline for the treatment of aggression after TBI. Studies reported the efficacy of both Propranolol (maximum dose 420-520 mg/day) and Pindolol (maximum dose 40-100 mg/day) in the treatment of aggression in this population. (ABIKUS A, adapted from GPT, 1 p.1482)

Tricyclic Antidepressant:

- G31** The use of tricyclic antidepressant is recommended as an option for the treatment of aggression after TBI if the options above are not effective. Specifically, Amitriptyline and Desipramine (both up to 150 mg/day) have been reported to be effective for the treatment of aggression in this population. (ABIKUS B, adapted from GPT, I, p.1492)

5. COGNITIVE REHABILITATION

- G32** All patients after moderate to severe ABI should be referred for neuropsychology, occupational therapy and speech language assessment to evaluate cognitive functioning. (ABIKUS C)
- G33** The treatment team should be multidisciplinary and is based on the individual's developing needs as determined by initial and ongoing assessments and goals. (ABIKUS C)
- G34** In order to facilitate/achieve generalization of skills/strategies to daily activities, rehabilitation should:
- ◆ Focus on engaging in activities that are perceived as meaningful
 - ◆ Include therapy interventions in the affected person's own environment and/or application to the person's own life
- (ABIKUS B)
- G35** Strategy training across all cognitive domains is recommended during postacute rehabilitation for persons with TBI. (ABIKUS A, adapted from Cicerone et al., 2005)

- G36** Cognitive rehabilitation should include the use of periodic, random auditory alerting tones to improve sustained attention in subacute ABI/TBI . (ABIKUS A, adapted from Cicerone et al., 2005)

5.1 LEARNING AND MEMORY

- G37** Cognitive rehabilitation should include the use of self instructional training/ internal training (e.g. self cueing, self talk). (ABIKUS A)
- G38** Cognitive rehabilitation should include the use of errorless learning for task specific learning for people with severe memory impairment. (ABIKUS B)

5.2 MEDICATION FOR MANAGEMENT OF MEMORY

Cholinesterase Inhibitors:

- G39** Donepezil (5-10 mg/day) is recommended to enhance aspects of memory function for patients with moderate to severe TBI in subacute and chronic periods of recovery. (ABIKUS B, adapted from GPT, I, p.1482)

Stimulants:

- G40** Methylphenidate in a dose of 0.30 mg/kg bid may be considered as an option to enhance learning and memory in persons who are within a few months of brain injury onset when other strategies are ineffective. (B, adapted from GPT, I, p.1483)

5.3 EXECUTIVE FUNCTIONS

- G41** Use of metacognitive strategy training (e.g. goal/ plan/ do/ review, goal management training) is recommended for people with executive dysfunction. (ABIKUS A)
- G42** The following interventions are not recommended due to demonstrated lack of efficacy:
- ◆ Sole reliance on repeated exposure and practice on computer based tasks without some involvement by a therapist
 - ◆ Specific structured attention programs using drill and practice
- (ABIKUS A)

5.4 MEDICATION FOR EXECUTIVE DYSFUNCTION

Dopamine Enhancers:

- G43** Bromocriptine in a dose of 2.5 mg is recommended for use in enhancing aspects of executive functioning (e.g. divided attention/ central executive functions) in patients with severe TBI. (B, adapted from GPT, I, p.1482)

5.5 MEDICATION FOR AROUSAL AND ATTENTION

Stimulants:

- G44** Methylphenidate (0.25-0.30 mg/kg bid) is recommended in adults to enhance attentional function in the adult population. Methylphenidate (0.25-0.30 mg/kg bid) is also recommended to enhance the speed of cognitive processing, although only one study provides evidence to support a change in speed in a naturalistic task. (A, adapted from GPT, I, p.1482)



Methylphenidate is not recommended in the pediatric population as it does not appear to produce significant differences in attention, behaviour, memory, or processing speed. (ABIKUS A)

6. COMMUNICATION REHABILITATION

- G45** A person with moderate to severe traumatic brain injury regardless of level of consciousness should be assessed by a speech-language pathologist for cognitive communication difficulties in accordance to existing practice guidelines of speech language pathologists and audiologists. (ABIKUS C, adapted from Turskstra et al., 2005)
- G46** Patients with severe communication disability should be assessed for and provided with appropriate alternative or augmentative communication aids. (B, adapted from RCP, G69, p.33)
- G47** A person with traumatic brain injury who has communication difficulties where achievable goals can be identified should be offered an appropriate treatment program by a speech language pathologist with monitoring of progress. (ABIKUS A)
- G48** A communication rehabilitation program should provide education and training of communication partners. (ABIKUS C, adapted from Togher et al., 2004a)

- G49** A communication rehabilitation program should give the opportunity to rehearse communication skills in situations appropriate to the context in which the patients will live/ work/ study/ socialize after discharge. (ABIKUS C)
- G50** The assessment and prescription of, augmentative and alternative communication devices should be made by suitability accredited clinicians: speech language pathologists (for communication), and occupational therapists (for access of devices, writing aids etc.). (ABIKUS C)
- G51** Staff should recognize that levels of communication competence may vary as a function of communication partner, environment, cognitive-communication demands, fatigue, psychosocial and physical variables. (ABIKUS B, adapted from Togher et al., 2004a)

7. REHABILITATION OF MOTOR FUNCTION AND CONTROL

- G52** Therapists (primarily physiotherapy and occupational therapy) need to be not only skilled in the physical management of neurological deficits, but also experienced in recognition and handling of associated cognitive and behavioural deficits, as well as orthopedic or associated musculoskeletal disorders, which may impact on the patient's ability to engage and cooperate in therapy sessions and to carry over physical gains into daily activities. (ABIKUS C)
- G53** Persons with moderate to severe ABI should be given opportunities to practice their motor skills outside of formal therapy. (ABIKUS A)
- G54** When planning a program to improve motor control, the following should be considered to improve motor control and general fitness:
- ◆ Strength training focusing on functional tasks (ABIKUS C)
 - ◆ Task-specific training (ABIKUS B)
 - ◆ Exercise training to promote cardiorespiratory fitness (ABIKUS A)
 - ◆ Gait re-education to improve mobility (ABIKUS C)
 - ◆ Expertise should be available in specialized seating (ABIKUS C)

8. SENSORY IMPAIRMENT

- G55** Persons with a moderate to severe ABI should be screened for visual impairment and/or perceptual deficits. (ABIKUS C)
- G56** Persons with a moderate to severe ABI with any visual impairment should be assessed by a team, which includes:
- ◆ Ophthalmologists
 - ◆ Persons with expertise in rehabilitation for the visually impaired (A, adapted from NZG 6.1.4, p.95)
- G57** Persons with a moderate to severe ABI with persistent visual neglect or field deficits should be offered specific retraining strategies. (ABIKUS A, adapted from NZG, 6.1.4, p.95)
- G58** Persons with a moderate to severe ABI with hearing loss should be assessed and treated by an audiologist. (ABIKUS C)
- G59** Persons with a moderate to severe ABI should be screened for vestibular dysfunction and if present, should undergo a vestibular retraining program. (ABIKUS B)

9. OPTIMIZING PERFORMANCE IN DAILY LIVING TASKS

- G60** All people with acquired brain injury who have difficulties in activities of daily living should be assessed by an occupational therapist, nurse or other health care practitioner with expertise in brain injury and experience in this area. (ABIKUS C, adapted from NZG, 6.2, p. 106)
- G61** All daily living tasks should be practiced in the most realistic and appropriate environment, with the opportunity to practice skills outside therapy sessions. (ABIKUS C, adapted from NZG, 6.2, p. 106 and RCP, G142, p. 47)
- G62** When providing training in the area of daily living tasks, the level of support provided should be matched to patient needs. Levels of support may range from direct physical assistance, cueing and prompting, set-up through to supervision. (ABIKUS C, adapted from NZG, 6.2, p. 106)

PART II

10. ASSESSMENT AND MANAGEMENT OF COMPLICATIONS

10.1 SPASTICITY

- G63** Persons with moderate to severe ABI with spasticity should be assessed and treated and provided with a coordinated plan for interdisciplinary management including:
- ◆ Identify and treat aggravating factors such as pain and infection
 - ◆ The use of specific treatment modalities such as serial casting or removable splints
 - ◆ The use of antispasmodic drugs (i.e. Baclofen, Tizanidine) including botulinum toxin where appropriate
 - ◆ Rehabilitation should consider a range of motion and positioning routine (ABIKUS C)

10.2 NUTRITION

- G64** All brain injured patients with significant ongoing impairment or disability should have their nutritional status assessed using a validated method, within 48 hours of admission (onset of injury). (ABIKUS B, adapted from RCP, G52, p.30)
- G65** Where patients are unable to maintain adequate nutrition orally, nutrition should be provided via nasogastric tube within 48 hours of injury, in collaboration with physician, dietician and nursing staff. (A, adapted from RCP G53, p. 30)
- G66** A dietician trained in the management of brain injury should review nutrition and hydration needs regularly. This should include regularly weighing the patient. (ABIKUS C, adapted from RCP, G55, p.30)
- G67** Nutritional needs may need to be changed according to changing metabolic demands. (ABIKUS B, adapted from RCP, G54, p.30)
- G68** If the patient is unable to take adequate nutrition orally for longer than 2-3 weeks after injury, Percutaneous Endoscopic Gastrostomy (PEG) or similar intervention should be instituted, unless contraindicated. (ABIKUS B, adapted from RCP, G56, p.30)

10.3 SWALLOWING

G69 Persons with moderate to severe ABI should:

- ◆ Be screened for risk of dysphagia and aspiration by an appropriately trained clinician
- ◆ Be assessed by a speech language pathologist if there are features of dysphagia or aspiration to determine the appropriate feeding strategy (ABIKUS A)

10.4 DEPRESSION

G70 Those determined to be depressed should receive appropriate treatment, which can consist of:

- ◆ Non-pharmacological treatments, which may include exercise and/or psychotherapy/counselling
- ◆ Pharmacological treatments (SSRIs are the first line of drug treatment) (ABIKUS B)

G71 Patients and their caregivers should be made aware of the risk of depression following TBI. (ABIKUS C)

G72 Persons with moderate to severe ABI are at future risk of depression and should be monitored on an ongoing basis for development of depression. (ABIKUS C)

10.5 PAIN

G73 Pain should always be considered if patient presents agitation or has cognitive/communication issues, non-verbal psychomotor restlessness or worsening spasticity and with particular attention paid to non-verbal signs of pain (e.g. grimacing). (ABIKUS C)

G74 Pain management protocols should be in place, which include:

- ◆ Regular review and adjustment
- ◆ Handling, support and pain relief appropriate to the individual needs
- ◆ Staff and caregivers should be educated about appropriate handling of paretic upper limbs during transfers, hypersensitivity and neurogenic pain (ABIKUS B, adapted from RCP, G114, p. 14)

10.6 HETEROTOPIC OSSIFICATION

- G75** The interdisciplinary team should be aware of the possibility of Heterotopic Ossification (HO) and protocols should be in place for early detection and management including:
- ◆ The use of three-phase bone scans to detect active areas of HO
 - ◆ The early use of Disodium Etidronate 30mg/kg/day for 2 months and/or Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) to limit evolution of HO
 - ◆ Surgical excision should be considered at a later stage if the limitation in joint motion hinders the patient's rehabilitation
- (B, adapted from RCP, G62, p. 31-32)
- G76** Forceful manipulation of joints under general anesthesia increases range of motion in patients with HO following brain injury. (ABIKUS B)

10.7 DEEP VEIN THROMBOSIS AND PULMONARY EMBOLUS

- G77** Deep vein thrombosis (DVT) are a common and potentially serious complication of TBI that can be circumvented by use of Low-Molecular Weight (LMW) unfractionated and /or compression stockings that can be used to prevent DVT/ Pulmonary Embolus (PE) post ABI. (ABIKUS B)
- G78** Prophylactic unfractionated heparin given early does not lead to increased intracranial bleeding in severe ABI patients. (ABIKUS B)

10.8 SEIZURE MANAGEMENT

- G79** Protocols should be in place for the management of acute seizures should they occur during rehabilitation. (C, adapted from RCP, G73, p. 33)

10.9 COMA, VEGETATIVE STATE AND MINIMAL CONSCIOUS STATE

- G80** For all patients with a diminished level of consciousness, assessment should be undertaken by a team with specialized experience in profound brain injury to establish the level of awareness and interaction. (C, adapted from RCP, G78, p. 34)

- G81** Where patients remain in coma or minimally conscious states, management in a specialized tertiary centre should be considered if the local services are unable to meet their needs for specialized nursing or rehabilitation. (C, adapted from RCP, G79, p. 34)
- G82** Every brain-injured patient who remains unconscious or is unable to sit themselves up should have a graded program to increase tolerance to sitting and standing. (C, adapted from RCP, G63, p. 32)

PART III

11. DISCHARGE PLANNING

- G83** Patients may be transferred back to the community, once appropriate specialized rehabilitation and support needed can be continued in that environment without delay. (ABIKUS C, adapted from RCP, G85, p. 36)
- G84** Preparing family/ caregivers and patient for community transition should include:
- ◆ Assessment of discharge destination environment and support available
 - ◆ Provision of any equipment and adaptations that are required
 - ◆ Training of caregivers/ family in the use of equipment and in managing the patient to ensure patient safety in the home environment
 - ◆ Educating patients and family/ caregivers about relevant formal and informal resources and how to access these resources including voluntary services and self-help groups
- (ABIKUS C, adapted from RCP, G86, p. 36)
- G85** Care plans should be agreed jointly between the patient and family/ caregivers and health care professionals from the services involved in the transition. A timely process for review of the care plan should be determined. (e.g. usually 3-6 months post discharge). (ABIKUS C, adapted from RCP, G88, p. 36)
- G86** Upon transfer or discharge, there should be a written report which includes:
- ◆ The results of all recent assessments
 - ◆ A summary of progress made and/or reasons for case closure
 - ◆ Recommendations for future intervention
 - ◆ Current needs
 - ◆ Key contacts and referrals made
 - ◆ Responsible services/professionals
 - ◆ Sources of continued information, support and advice
- (ABIKUS C, adapted from RCP, G89, p. 37 and RCP, G87, p.36)
- G87** Copies of both the care plan and the discharge report should be provided to the patient/ family/ caregivers and all professionals relevant to the patient's current stage of rehabilitation, especially the General Practitioner (GP). (C, adapted from RCP, G90, p. 37)

12. COMMUNITY REINTEGRATION

12.1 ASSISTIVE TECHNOLOGY

- G88** The prescription of equipment should take account of any cognitive and behavioural deficits and their constraints on the person's ability, or their family/ caregiver's ability, to use the equipment safely and appropriately. Where this in doubt, arrangements should be in place for regular review. (C, adapted from NZG, 6.2, p. 107)
- G89** Patients and their family/caregivers should be given clear written information on who to contact for repairs, replacement or future help and advice regarding the equipment. The ongoing effectiveness of equipment should be reviewed on a regular basis and in accordance with the manufacturers' guidelines. (C, adapted from NZG, 6.2, p. 107)

12.2 DRIVING

- G90** For all patients with a moderate to severe ABI, including adolescents, a physician with experience of brain injury should screen patients who wish to drive, in accordance with legislation, where appropriate in liaison with the multidisciplinary team. (ABIKUS C, adapted from RCP, G156, p. 49)
- G91** If members of the interdisciplinary rehabilitation team during assessment or treatment determine that the person's ability to operate a motor vehicle safely may be affected, then they should:
- ◆ Advise the patient and/or their advocate that they are obliged by law (if applicable) to inform the relevant government body that the individual has suffered a neurological or other impairment and to provide the relevant information on its effects
 - ◆ Provide information about the law and driving after brain injury
 - ◆ Provide clear guidance for the GP, other treating health professionals and family/caregivers, as well as the patient, about any concerns about driving, and reinforce the need for disclosure and assessment in the event that return to driving is sought late post-injury
- (ABIKUS C, adapted from RCP, G155, p. 49)
- G92** If the patient's fitness to drive is unclear, a comprehensive assessment of capacity to drive should be undertaken at an approved driving assessment centre. (C, adapted from RCP, G157, p. 49)



12.3 VOCATIONAL REHABILITATION

- G93** Patients seeking a return to employment, education or training should be assessed by a professional or team trained in vocational needs following brain injury. Assessment should include:
- ◆ Evaluation of their individual vocational and/or educational needs
 - ◆ Identification of difficulties which are likely to limit the prospects of a successful return and appropriate intervention to minimize them
 - ◆ Direct liaison with employers (including occupational health services when available), or education providers to discuss needs and the appropriate action in advance of any return
 - ◆ Evaluation of environmental factors, workplace, psychosocial aspects including social environment and work culture
 - ◆ Verbal and written advice about their return, including arrangements for review and follow-up
- (ABIKUS C, adapted from RCP, G159 , p. 50)
- G94** Clinicians involved in brain injury rehabilitation should consider vocational needs and put patients in touch with the relevant agencies as part of their routine planning, and refer where appropriate, to a specialist vocational rehabilitation program. (C, adapted from RCP, G158, p. 50)
- G95** In setting up placement into a long-term job, monitoring should be provided for at least six months or longer to respond to any emergent difficulties, with a follow-up thereafter to establish the long-term viability of the placement. (ABIKUS C, adapted from RCP, G164, p. 51)

12.4 LEISURE AND RECREATION

- G96** All patients should be assessed by a rehabilitation professional or team to identify:
- ◆ Level of participation in leisure activities (including indoor and outdoor pursuits) based on the individual's personal preferences
 - ◆ Barriers or compounding problems which inhibit their engagement in such activities.
- (ABIKUS C, adapted from RCP, G150, p. 48 and NZG, 6.5, p. 113)
- G97** Patients with difficulty undertaking leisure activities of their choice should be offered a goal directed community-based program aimed at increasing participation in leisure and social activities, in liaison with local volunteer organizations. (ABIKUS B, adapted from RCP, G151, p. 48)

13. FAMILY AND CAREGIVERS

- G98** Rehabilitation programs should be developed in collaboration with family, caregivers or nursing staff to ensure that the program is carried over into daily activities. (ABIKUS C, adapted from RCP, G23, p.21)
- G99** Individuals who have assumed the caregiver role (e.g. family members, paid caregivers) should be individually assessed by a member of the treating team (e.g. a social worker), at regular intervals thereafter, for (but not limited to) the following:
- ◆ To establish their own needs and to increase the sustainability of the caring role
 - ◆ The care provided (e.g. equality, extent)
 - ◆ The need for support, including respite care
 - ◆ The need for training/ education
 - ◆ The caregiver's stress and mental health issues
 - ◆ The caregiver's capacity and opportunity to maintain previous roles (Note that it should not be assumed that family members will be willing to take on the caregiver role). (ABIKUS C, adapted from NZG, 13, p. 157)
- G100** Additional support should be provided for caregiver/family, including:
- ◆ Crisis support
 - ◆ Training and education for the caregiver role
 - ◆ Training in behavioural management techniques when the person with traumatic brain injury has behavioural and personality changes resulting from the traumatic brain injury
 - ◆ Respite care
- (ABIKUS C, adapted from NZG, 13, p. 158)
-  Families of children with traumatic brain injury need provision of support aimed at enhancing the following:
- ◆ Social support
 - ◆ Family relationships and functioning
 - ◆ Stress management
 - ◆ Help with adjusting to the new situation
- (ABIKUS C, adapted from NZG, 13.2, p. 162)
-  The need of siblings for support, assessment and education should be considered. (ABIKUS C, adapted from NZG, 12.3.2, p. 153)



Formal support programs should be developed and provided for the family, caregivers and siblings of children with traumatic brain injury. (ABIKUS C, adapted from NZG, 13.2, p. 162)



All teachers, particularly special education staff and resource teachers for learning and behaviour should be routinely trained to recognize patterns of impairment resulting from traumatic brain injury and to seek specialist advice, where appropriate. (ABIKUS C, adapted from NZG, 12.3.2, p. 153)

14. BRAIN INJURY AWARENESS AND EDUCATION

G101 All sectors of the population require awareness of the needs of people with brain injury, particularly the education sector. (ABIKUS C)

G102 Content information required for those in the education sector should be specialized according to level of schooling and should consider all of the following: the need for extra academic supports; differences between traditional learning disabilities and acquired brain injury; there may be discrepancies between preserved intellect and person's level functioning; psychosocial requirements; and the impact of a prior moderate to severe brain injury on later school performance, even in children who appeared to have fully recovered. (ABIKUS C)

TERMINOLOGY

Acquired Brain Injury (ABI)

An acquired brain injury is damage to the brain which occurs after birth and is not related to:

- A congenital disorder
- A developmental disability or
- A process which progressively damages the brain (see Appendix I)

The damage may be caused:

- Traumatically (i.e., from an external force such as a collision, fall, assault or sports injury)
- Through a medical disease process which causes damage to the brain (internal process or pathology). (see Appendix II)

Appendix I

Congenital Development Problems (not considered ABI):

- Cerebral Palsy
- Autism
- Developmental Delay
- Down's Syndrome
- Spina Bifida with hydrocephalus
- Muscular Dystrophy

Progress Processes/Diseases (not considered ABI):

- Alzheimer's Disease
- Pick's Disease
- Dementing Processes
- Amyotrophic Lateral Sclerosis
- Multiple Sclerosis
- Parkinson's Disease and Similar Movement Disorders
- Huntington's Disease

Appendix II

Non-Traumatic Causes of ABI:

- Anoxia
- Aneurysm and Vascular Malformations
- Brain Tumours
- Encephalitis
- Meningitis
- Metabolic Encephalopathies
- Stroke with Cognitive Disabilities

Acute Care

Takes place in the hospital setting and focus is on medical assessment, treatment and monitoring of urgent and emergent medical conditions with the aim of achieving medical stability.

Assistive Technology

Adaptive devices used to improve function, independence and quality of life across a wide range of modalities including communication, physical function and cognition.

Balance

Postural stability at rest or during activities.

Balance Re-training

Sensory, motor and/or cognitive interventions to promote postural stability and coordinated limb movements during postures, functional tasks and/or after perturbations.

Behavioural Rehabilitation

The process of reducing the inappropriate or maladaptive thinking, feeling or action patterns brought about by an acquired brain injury.

Caregiver

Any paid or unpaid human resource responsible for supporting another individual.

Case Management

Facilitating the access of a patient to appropriate medical, rehabilitation and support programs, and coordination of the delivery of services.

Client and Family Centered Care

Care that is centered around the goals set with the client and family.

Cognition

The conscious process of knowing or being aware of thoughts or perceptions, including understanding and reasoning.

Cognitive-Communication Disorder

Communication impairments resulting from underlying cognitive deficits due to neurological impairment including difficulties in communicative competence (listening, speaking, reading, writing, conversation and social interaction). These are distinct from other neurological communication disorders (e.g. aphasia, dysarthria, etc).

Cognitive Rehabilitation

Interventions aimed at minimizing the functional impact of disabilities arising from impairments in cognitive functions such as perception, attention, memory, problem solving, and organization.

Community Based Rehabilitation Therapy

Rehabilitation provided in the home or community based setting.

Community Reintegration

Process of re-engaging in social roles, recreational and vocational activities following acquired brain injury.

Coma

A state of unconsciousness from which the patient cannot be awakened or aroused, even by powerful stimulation; lack of any response to one's environment. Defined clinically as an inability to follow a one-step command consistently; Glasgow Coma Scale score of 8 or less.

Counseling

A verbally-based therapeutic process focused on assessing motivation and capacity in order to develop self-awareness and opportunity for behavioural change.

Computed Tomography (CT) Scan

A CT scan is a computer-aided X-ray used to provide clear pictures of brain structures for diagnostic and interventional purposes.

Dual-diagnosis

Refers to a person who has an ABI with a concurrent psychiatric problem in which the manifestation of the psychiatric problem is the more significant issue.

Dystonia

A neurological movement disorder in which sustained muscle contractions cause twisting and repetitive movements or abnormal postures.

Executive Function

Those thinking abilities involved in attention, working memory, learning and episodic memory, problem solving, organization, planning and judgment, self-awareness and insight. Executive function also includes the ability to control behaviour so that is adaptive and appropriate to the situation. Behavioural control refers to the ability to regulate and direct the expression of mood, impulses, and motivation.

Follow-Up

The assessment of the individual following the end of a phase of rehabilitation to determine the effects of services, outcomes attained and the durability of outcomes to determine the status of the individual and future needs.

Goal-setting

Identifying specific and measurable targets for the rehabilitation process, ideally by agreement between the rehabilitation team and the affected individual, and ideally involving their family or caregivers.

Glasgow Coma Scale

A standardized system used to assess the degree of brain impairment and to identify the seriousness of injury in relation to outcome. The system involves three determinants: eye opening, verbal responses and motor response all of which are evaluated independently according to a numerical value that indicates the level of consciousness and degree of dysfunction. Scores run from a high of 15 to a low of 3. Persons are considered to have experienced a 'mild' brain injury when their score is 13 to 15. A score of 9 to 12 is considered to reflect a 'moderate' brain injury and a score of 8 or less reflects a 'severe' brain injury.

Heterotopic Ossification

The development of bony substances in normally soft tissues.

Intensity

The duration, frequency and demands of the therapeutic intervention.

International Classification of Functioning, Disability and Health (ICF)

The ICF, developed by the World Health Organization, is a classification of health and health related domains that describe how people live with their health condition from body, individual and societal perspectives. Since an individual's functioning and disability occurs in a context, ICF also includes a list of environmental factors.

Interdisciplinary Rehabilitation

A rehabilitation approach in which all members of a rehabilitation team, including the affected individual and the family and caregivers, communicate and work together to achieve the affected individual's needs and goals which cross discipline boundaries.

Intervention

An active treatment approach designed to improve a specific or general outcome such as patient programming, medication treatment or behavioural strategy.

Managed Clinical Network

The concept of linking service providers across specialty and organizational boundaries to help them to work effectively in delivering health care: the aim is to create a framework or pathway of patient care characterized by optimal standards, clinical effectiveness, smooth transitions, comprehensiveness, equity of access, and good clinical communication.

Metacognition

Refers to thinking and/or reasoning about one's own thinking (including memory, attention, and executive function). This includes the use of strategies applicable to many different situations, for example, thinking about the need to and actually writing down appointments in a day-timer.

MRI–Structural

Structural MRI stands for magnetic resonance imaging, a technique for creating internal images of the body and brain

Multi-Disciplinary Team (MDT)

A team consisting of professionals (+ others) from several disciplines, brought together by a common interest in the management of certain clinical conditions. In the context of acquired brain injury, that commonly includes medicine, nursing, physiotherapy, occupational therapy, speech & language therapy, clinical (neuro) psychology, dietetics, and social work/care management. Team members must see the team as an entity, meet regularly to discuss patients/clients, and share patient records.

Neurologic Deficit

Sensory, motor or communication impairment secondary to central or peripheral nervous system injury in the context of the neurologic examination.

Outcome

The status of the individual measured by the individual's functional abilities and performance.

Outpatient

The patient residing outside the hospital but returning on a regular basis for one or more therapeutic services.

Persistent Vegetative State (PVS)

A long-standing condition in which the patient utters no words and does not follow commands or make any response that is meaningful.

Postacute Rehabilitation

Are programs designed to provide intensive, rehabilitation to improve cognitive, physical, emotional, and psychosocial abilities, and to facilitate better independent living skills. Community based services typically provide a full spectrum of clinical therapies, as well as life-skills training in a community setting.

Post Traumatic Amnesia (PTA)

The period of time after the injury when the affected person exhibits a loss of day-to-day memory. May also be called Anterograde Amnesia.

Rehabilitation

A progressive, dynamic, goal-oriented and usually time-limited process, that aims to enable an individual with impairment(s) to identify and reach his/her optimal mental, physical, cognitive and/or social functional level. Rehabilitation also provides opportunities for the individual, the family and the community to accommodate a limitation or loss of function and aims to facilitate social integration and independence.

Restraint

Physical, mechanical, chemical or environmental means of restricting a person's activities or movements.

Seizure

Sudden and unstoppable alteration in behaviour caused by excessive electrical activity of the brain that can manifest itself as simply unresponsive staring, focal movement of a limb to an altered level of awareness to uncontrollable shaking of all 4 limbs with associated loss of consciousness.

Self Management

Interventions, training, and skills by which patients with a chronic condition, disability, or disease can effectively take care of themselves and learn how to do so.

Self-Care

Daily activities such as bathing, grooming, feeding, dressing and toileting.

Spasticity

Velocity-dependent increase in muscle tone (i.e. an increase in muscle stiffness above the normal level in response to movement).

Tone

Muscle tone is evaluated as the amount of resistance of a limb where resistance arises from passive and active forces. OR: Muscle tone (aka residual muscle tension or tonus) is the continuous and passive partial contraction of the muscles.

Traumatic Brain Injury Severity

Severity of brain injury is classified by evaluating three indicators consisting of 1) Glasgow Coma Score (GCS) which indicates the depth of coma, 2) the duration of loss of consciousness (LOC) and 3) the duration of post-traumatic amnesia (PTA) which indicates the period of time after the brain injury during which the individual is not able to consistently remember day-to-day events. The table below indicates the values of these indicators associated with moderate and severe brain injury. No single indicator of injury severity should be considered in isolation. When evaluating brain injury severity the functional status of the brain injury survivor should also be considered.

Vestibular

Pertaining to the (vestibular) system in the middle ear and brain that senses movements of the head. Disorders of the vestibular system can lead to dizziness, poor regulation of postural muscle tone and inability to detect quick movements of the head.

Vocational Rehabilitation

Assessment and interventions designed to assist individuals to engage or re-engage in productive activities such as employment, retraining/education, or volunteerism.

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ABIKUS

Acquired Brain Injury Knowledge Uptake Strategy