

# CLINICAL PRACTICE GUIDELINE FOR THE REHABILITATION OF ADULTS WITH MODERATE TO SEVERE TBI

October 2016

## SECTION II: Assessment and Rehabilitation of Brain Injury Sequelae

The content of these guidelines are based on the status of scientific knowledge available at the time of their finalization (2015) as well as on the opinion of the experts who participated in the development of the guidelines. Choices reflected in these guidelines do not preclude the possibility of other approaches or practices also being valid and relevant. Healthcare professionals must at all times use their clinical judgment and consider other factors such as patient preferences and resource availability in applying these recommendations. Moreover, healthcare professionals must at all times respect the legal and normative regulations of the regulatory bodies, in particular with regards to scopes of practice and restricted/protected activities, as these may differ provincially.

# H

## Comprehensive Assessment of the Person with TBI

### H1 – Principles of Assessment

#### H 1.1



All individuals with traumatic brain injury who are conscious, including those in post-traumatic amnesia (PTA), should be assessed for common impairments including:

- Motor impairments, such as weakness, altered tone, balance and incoordination
- Possible missed injuries/fractures
- Pain
- Bulbar problems affecting speech and swallowing
- Sensory dysfunctions that may impact on safety including hearing loss, numbness, visual problems (including reduced acuity, visual field loss, gaze palsies)
- Reduced control over bowels and bladder
- Cognitive dysfunctions such as impairments in attention, orientation and memory
- Behavioural dysregulations including potential emotional/behavioural issues

(Adapted from INCOG, Assess 1, p. 296)

#### H 1.2



The initial management of individuals with traumatic brain injury should be guided by clinical assessments and protocols based on the Glasgow Coma Scale (GCS) score. (Adapted from ABIKUS 2007, G6, p. 16)

#### H 1.3



Assessment should include seeking information from family and individuals who may be caring for the person following the traumatic brain injury. (Adapted from INCOG, Assess 5, p. 297)



## H1 – Principles of Assessment

### H 1.4



All individuals with traumatic brain injury who have emerged from post-traumatic amnesia/ post-traumatic delirium (PTA/PTD) should have their cognitive function evaluated by a:

- Neuropsychologist: to conduct a formal cognitive assessment using validated neuropsychological tests including measures of effort, emotional status and behavioural problems
- Occupational therapist: to assess the impact of cognitive impairments on performance of meaningful activities and participation
- Speech-language pathologist: to assess the impact of cognitive impairments on communication (listening, speaking, reading, and writing)

Assessment should be collaborative, and all professionals involved should aim to integrate their assessment findings, and avoid overtesting or duplicating tests with each other.

(Adapted from INCOG 2014, Assess 10, p. 298)

### H 1.5



After emerging from post-traumatic amnesia / post-traumatic delirium (PTA/PTD), all individuals with traumatic brain injury should be assessed for the presence of cognitive impairments in the following areas:

- Attention (including speed of processing)
- Visuospatial function
- Executive function
- Language, social communication
- Social cognition
- Learning and memory
- Awareness of impairments
- Detection/expression of emotion

This assessment may be either standardized or non-standardized depending on a number of factors, such as apparent rate of recovery and need of data for future planning. A formal standardized evaluation should be completed before initiating a cognitive rehabilitation program.

(Adapted from INCOG 2014, Assess 3, p. 296)

### H 1.6



At the end of an assessment, the person with traumatic brain injury and the primary caregiver should be informed and have a discussion of his/her diagnosis, his/her prognosis, the recovery process and the treatments that are available. (INESSS-ONF, 2015)

### H 1.7



Depending on the mechanism of injury, individuals with other injuries, such as spinal cord injury or severe musculoskeletal injuries, should be screened by healthcare professionals for evidence of traumatic brain injury. (INESSS-ONF, 2015)

REFERENCES:

- Sharma et al. (2014)
- Bradbury et al. (2008)

### H 1.8



Individuals with comorbidities, such as spinal cord injury or severe musculoskeletal injuries, should have timely access to interdisciplinary traumatic brain injury (TBI) services. TBI services should be concurrent with other therapies or should immediately follow former therapies. (INESSS-ONF, 2015)

# Disorders of Consciousness

## I1 – Assessment of Consciousness

<b>I 1.1</b> <b>C</b>	All individuals with traumatic brain injury who have a disorder of consciousness require regular medical and neurological assessments and serial monitoring. (Adapted from NZGG 2006, 2.2.4, p. 39)
<b>I 1.2</b> <b>P C</b>	<p>Immediate medical and physical re-evaluation should be conducted when a fall or unexpected change in the Glasgow Coma Scale (GCS) score of more than 2 points (or a fall in another appropriate metric reflecting neurological status, e.g. CRS-R) is observed in a person with disorders of consciousness. (Adapted from NZGG 2006, 2.2.1, p. 37)</p> <p>Note: Deterioration in the GCS scores or failure to improve as expected with time post-injury should trigger immediate re-evaluation of the clinical situation with investigation urgency and/or urgent referral commensurate with the clinical situation.</p>
<b>I 1.3</b> <b>C</b>	<p>Diagnosis of vegetative state (VS) or minimally conscious state (MCS) following traumatic brain injury should be based on assessment:</p> <ul style="list-style-type: none"><li>· By appropriately trained clinicians who are experienced in VS or MCS:<ul style="list-style-type: none"><li>→ Under suitable conditions</li><li>→ Using validated structured assessment tools</li><li>→ In a series of observations over an adequate period of time</li></ul></li><li>· In conjunction with clinical reports of behavioural responses gleaned from:<ul style="list-style-type: none"><li>→ The care records</li><li>→ Interviews with family members / healthcare professionals</li></ul></li></ul> <p>(RCP 2013, Section 2; 2.3, p. 33)</p>
<b>I 1.4</b> <b>B</b>	<p>Clinicians should work closely with the family members of the person with traumatic brain injury with prolonged disorders of consciousness (PDOC), explaining what behaviours to look for and how to distinguish higher-level responses from reflex activity. Where appropriate, families may also be encouraged to use tools or videos to record their observations. (Adapted from RCP 2013, Section 2; 2.4, p. 33)</p> <p>Note: Families play an active role in the assessment of individuals with PDOC because individuals may respond at an earlier stage to their families/loved ones.</p>

## I2 – Post-Traumatic Amnesia

<b>I 2.1</b> <b>C</b>	Post-traumatic amnesia (PTA) assessment of a person with traumatic brain injury should be performed on a serial basis using a validated tool, until resolution of the PTA. (Adapted from NZGG 2006, 2.2.3, p. 38, INCOG 2014, Assess 2; PTA 1, p.296 and INCOG 2014, PTA 1, p. 314)
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## I2 – Post-Traumatic Amnesia

### I 2.2



To minimize agitation and confusion associated with post-traumatic amnesia (PTA), individuals with traumatic brain injury (TBI) should remain in a secure and supervised environment until they have emerged from PTA. It is recommended to:

- Maintain a quiet and consistent environment on the ward and avoid overstimulation
- Consider the use of low-stimulation rooms
- Evaluate the impact of visitors, assessment and therapy and limit these activities if they cause agitation or excessive fatigue, allowing rest as needed
- Minimize the use of restraints while facilitating the use of alternate measures in order to allow the person to move around freely
- Have consistent healthcare professionals or trained caregivers working with the person with TBI
- Establish the most reliable means of communication
- Provide frequent reassurance
- Present familiarizing information as tolerated by the person
- Help family members understand PTA and how to minimize triggering agitation

(Adapted from INCOG 2014, PTA 3, p. 314)

# J

## Cognitive Functions

### J1 – Évaluation des fonctions cognitives

#### J 1.1



During assessment of a person with traumatic brain injury, clinicians should consider the possibility of other factors that may be contributing to cognitive performance impairments and functional limitations including:

- Personal factors
- Pre-injury medical conditions
- Injury-related factors and conditions

(Adapted from INCOG 2014, Assess 6, p. 297)

Note:

Personal factors include:

- Cultural background
- Fluency and literacy in language of assessment
- Level of education/academic history/premorbidity learning difficulties
- Premorbid intellectual level of functioning
- Occupational/vocational history
- Recreational, hobby history

Pre-injury medical conditions include:

- Substance use/abuse
- Mental health issues

- Psychosocial trauma or abuse
  - Neurological disorders (e.g., dementia, seizures)
  - Hearing or vision impairment
  - Nutritional status
- Injury-related factors and conditions include:
- Medical conditions
  - Psychiatric conditions, especially mood disorders
  - Fatigue
  - Sleep-wake disorders
  - Medications (pre- and post-injury) including over-the-counter remedies, herbs or supplements
  - Seizures
  - Sensorimotor changes
  - Endocrine dysfunction (e.g., growth hormone deficiency) (High 2010)
  - Pain
  - Acquired language changes (e.g., aphasia, dysgraphia)
  - Injury-related vision or hearing deficits
  - Manual limb or oral-motor dysfunction (e.g., weakness, incoordination)
  - Consider the possibility of other comorbid factors

## J2 – Cognitive Rehabilitation Principles

<p><b>J 2.1</b></p> <p><b>P C</b></p>	<p>Individuals with persistent cognitive deficits following traumatic brain injury should be offered functionally-oriented cognitive rehabilitation. Treatment must be considered within a framework that considers the person’s pre-injury characteristics, stage of development and recovery, and personally meaningful everyday activities and life contexts.</p> <p>(Adapted from NZGG 2006, 6.1.6, p. 98 and INCOG 2014, Assess 12, p. 299)</p>
<p><b>J 2.2</b></p> <p><b>P B</b></p>	<p>Cognitive rehabilitation in the acute phase for individuals with traumatic brain injury should be managed in a structured and distraction-free environment.</p> <p>(Adapted from NZGG 2006, 6.1.6, p. 98)</p>
<p><b>J 2.3</b></p> <p><b>P B</b></p>	<p>To facilitate/achieve generalization of skills/strategies to daily activities for the person with traumatic brain injury, rehabilitation should:</p> <ul style="list-style-type: none"> <li>· Focus on activities that are perceived as meaningful by the person</li> <li>· Include therapy interventions provided in the person’s own environment and/or adapted to the person’s own life.</li> </ul> <p>(Adapted from ABIKUS 2007, G34, p. 21)</p>

## J3 – Medication for Arousal and Attention

<p><b>J 3.1</b></p> <p><b>P B</b></p>	<p>Methylphenidate (initiated at a dose of approximately 0.10mg/kg and increased gradually to a target of 0.25–0.30 mg/kg bid) is recommended in adults with traumatic brain injury to enhance attentional function and speed of information processing.</p> <p>(Adapted from ABIKUS 2007, G44, p. 23 and INCOG 2014, Attention 9, p. 331)</p>
<p><b>J 3.2</b></p> <p><b>C</b></p>	<p>Dextroamphetamine should be considered to enhance attentional function after traumatic brain injury when methylphenidate is not tolerated. (Adapted from NGWG 2006, p. 1483)</p>

### J3 – Medication for Arousal and Attention

J 3.3

B

Consider amantadine to improve attention in individuals with traumatic brain injury who are out of post-traumatic amnesia and who have not responded to other medication alternatives. (Adapted from NGWG 2006, p. 1483)

J 3.4

P

A

Amantadine may be considered to enhance arousal and consciousness and accelerate the pace of functional recovery in individuals in vegetative or minimally responsive state following traumatic brain injury. (Adapted from SIGN 2013, 9.2, p. 36)

REFERENCE:

- Giacino et al. (2012)

### J4 – Attention/Information Processing

J 4.1

P

A

Metacognitive strategy training using functional everyday activities should be considered for individuals with traumatic brain injury, especially those with mild-moderate **attention deficits**. (Adapted from INCOG 2014, Attention 1, p. 330)

J 4.2

P

A

Training in dual-tasking for individuals with traumatic brain injury can be used to improve dual-task performance, only on tasks similar to those trained. (Adapted from INCOG 2014, Attention 2, p. 330)

J 4.3

P

C

Cognitive behaviour therapy should be considered for improving attentional functioning in individuals with traumatic brain injury with attentional deficits thought to be secondary to sleep-wake disorders, pain, fatigue, polypharmacy or anxiety and/or depression. (Adapted from INCOG 2014, Attention 3 and 4, p. 330)

J 4.4

C

Alterations to the environment and tasks may be used to reduce the impact of attentional problems on daily activities for individuals with traumatic brain injury. (INCOG 2014, Attention 5, p. 330)

J 4.5

B

Reliance on repeated exposure and practice on de-contextualized computer-based attentional tasks for individuals with traumatic brain injury are **NOT** recommended because of lack of demonstrated impact on everyday attentional functions. (INCOG 2014, Attention 6, p. 330)

J 4.6

B

Training with periodic random auditory alerting tones for individuals with attentional deficits following traumatic brain injury should **NOT** be conducted in therapy outside of a research protocol, as current evidence is conflicting. (Adapted from INCOG 2014, Attention 7, p. 331)

## J5 – Learning and Memory

<p><b>J 5.1</b></p> <p><b>P</b> <b>A</b></p>	<p>Teaching internal compensatory strategies may be used for individuals with traumatic brain injury who have memory impairments. Their use tends to be most effective with individuals who have <b>mild-to-moderate range impairments</b> and/or some preserved executive cognitive skills. These strategies include instructional and/or metacognitive strategies (e.g., visualization/visual imagery, repeated practice, retrieval practice, Preview, Question, Read, State, Test [PQRST], self-cueing, self-generation, self-talk). Using multiple strategies is considered effective, and strategies can be taught individually or in a group format. (INCOG 2014, Memory 1, p. 372)</p>
<p><b>J 5.2</b></p> <p><b>B</b></p>	<p>Cognitive skill training for individuals with traumatic brain injury should be strategy-focused and conducted with an experienced therapist who can further facilitate the functional integration of the strategy being practised into meaningful and practical tasks. (Adapted from INCOG 2014, Memory 7, p. 374)</p> <p>Note: There is limited evidence to suggest that using restorative techniques such as computer-based training strategies alone is effective.</p>
<p><b>J 5.3</b></p> <p><b>P</b> <b>B</b></p>	<p>Environmental supports and reminders (e.g., mobile/smartphones, notebooks and whiteboards) are recommended for individuals with traumatic brain injury (TBI) who have memory impairment, and most especially for those who have severe memory impairment. Individuals with TBI and their caregivers must be trained in how to use these external supports. (Adapted from INCOG 2014, Memory 3, p. 372)</p> <p>Note: The selection of environmental supports and reminders should take into account the following factors regarding the person with TBI:</p> <ul style="list-style-type: none"><li>· Age</li><li>· Severity of impairment</li><li>· Premorbid use of electronic and other memory devices</li><li>· Cognitive strengths and weaknesses (e.g., executive cognitive skills)</li><li>· Physical comorbidities</li></ul>
<p><b>J 5.4</b></p> <p><b>P</b> <b>A</b></p>	<p>The following practices are recommended to promote learning for individuals with memory impairments following traumatic brain injury (TBI):</p> <ul style="list-style-type: none"><li>· Clearly define intervention goals.<ul style="list-style-type: none"><li>→ Selection of and training of goals that are relevant to the person with TBI (i.e., ecologically valid)</li></ul></li><li>· Allow sufficient time and opportunity for practice.</li><li>· Integrate methodologies that allow for breaking down tasks into smaller components such as task analysis when training multistep procedures.</li><li>· Use principles of distributed practice.</li><li>· Teach strategies using variations in the stimuli/information being presented (e.g., multiple exemplars, practical tasks).</li><li>· Promote strategies that allow for more effortful processing of information/stimuli (e.g., verbal elaboration, visual imagery).</li><li>· Use teaching strategies that constrain errors (e.g., errorless, spaced retrieval) when acquiring new or relearning information and procedures.</li></ul> <p>(Adapted from INCOG 2014, Memory 4, p. 373)</p>

## J5 – Learning and Memory

**J 5.5**

**B**

Group-based interventions may be considered for enhancing memory capacity with individuals with mild-to-moderate **memory deficits** following traumatic brain injury. (Adapted from INCOG 2014, Memory 5, p. 373)

## J6 – Medication for Memory

**J 6.1**



**B**

Rivastigmine may be considered for individuals with moderate-to-severe memory impairment in the subacute to chronic phase of recovery after traumatic brain injury. (INESSS-ONF, 2015)

REFERENCE:

- Silver et al. (2009)

**J 6.2**

**P**

**B**

Donepezil (5–10 mg/day) is recommended to enhance aspects of memory in individuals with traumatic brain injury. (Adapted from NGWG 2006, p. 1482)

## J7 – Executive Functions

**J 7.1**

**P**

**A**

Metacognitive strategy instructions (e.g., goal management training, plan-do-check-review, prediction performance) should be used with individuals with traumatic brain injury (TBI) for difficulty with problem-solving, planning and organization. Common elements of all metacognitive strategies are self-monitoring and incorporation of feedback into future performance. These strategies should be focused on everyday problems and functional outcomes of personal relevance to the person. (Adapted from INCOG 2014, EXEC 1, p. 343)

Note: Metacognitive strategy instruction is optimized when the person with TBI has awareness of the need to use a strategy and can identify contexts in which the strategy should be used.

**J 7.2**

**P**

**A**

Strategies to improve the capacity to analyze and synthesize information should be used with individuals with traumatic brain injury who have impaired reasoning skills. (INCOG 2014, EXEC 2, p. 343)

**J 7.3**

**P**

**A**

Strategies that encourage monitoring of performance and feedback should be used with individuals with traumatic brain injury who have impaired self-awareness. (Adapted from INCOG 2014, EXEC 3, p. 343)

**J 7.4**

**B**

Group-based interventions should be considered for remediation of executive and problem-solving deficits after traumatic brain injury. (Adapted from INCOG 2014, EXEC 4, p. 343)



# K

# Cognitive Communication

## K1 – Cognitive Communication Assessment

### K 1.1



Assessment of cognitive communication abilities of individuals with traumatic brain injury should include:

- A survey or broad variety of communication situations, complexities and environments
- A case history
- The consideration of standardized and non-standardized assessments/surveys
- Specific assessments in the following areas:
  - Attention and concentration
  - Orientation
  - Verbal memory and new learning
  - Linguistic organization
  - Auditory comprehension and information processing
  - Hearing and vision
  - Oral expression and discourse
  - Reading comprehension and reading rate
  - Written expression
  - Social communication and pragmatics
  - Reasoning and problem-solving
  - Executive functions and metacognitive processes
  - Insight, awareness and adjustment to disability
  - Speech
  - Nonverbal communication
  - Consideration of visual, perceptual, pain, fatigue, and other physical difficulties
  - Performance in different communication contexts
  - Communication partners' needs and abilities to provide communication support and strategies

(INESSS-ONF, 2015)

REFERENCE:

- College of Audiologists and Speech-Language Pathologists of Ontario (CASLPO) (2015) p.15

### K 1.2



A cognitive communication evaluation and rehabilitation program for individuals with traumatic brain injury should take into account the person's premorbid:

- Physical and psychosocial variables
- Native language
- Literacy and language proficiency
- Cognitive abilities
- Communication style, including communication standards and expectations in the person's culture

(Adapted from INCOG 2014, Cognitive Communication 3, p. 356)

## K1 – Cognitive Communication Assessment

### K 1.3

B

Rehabilitation staff should recognize that levels of communication characteristics may vary as a function of:

- Communication partner: individuals with traumatic brain injury may communicate at a higher level with family and friends who know them well than with healthcare professionals
- Environment
- Communication demands (e.g., time pressure, need to follow multiple speakers)
- Communication priorities
- Fatigue
- Physical variables
- Psychosocial variables
- Other personal factors

(Adapted from INCOG 2014, Cognitive Communication 1, p. 356)

## k2 – Cognitive Communication Rehabilitation

### K 2.1

C

A person with traumatic brain injury who has a cognitive communication disorder should be offered an appropriate treatment program. (Adapted from INCOG 2014, Cognitive Communication 2, p. 356)

Note: The primary goal of management is to facilitate the maximum return to full life participation. Evidence to date favours management approaches that are individualized, functional, goal- and outcome-oriented, patient-centred, and grounded in the contexts of real life communications and cognitive demands. Intervention should take place in a variety of environments and should provide opportunities for rehearsal of communication skills (Togher et al., 2014). Treatment can be both direct and indirect, and can include:

- Improving and restoring cognitive communication functions
- Assisting with a gradual reintegration to daily functions and productive activities that require cognitive communication skills
- Modification of the communication environment
- Training communication partners and improving communication environments and settings
- Assisting with adjustment to impairments, coping strategies, confidence and self-esteem
- Compensatory strategy training
- Provision of education and information regarding the nature of acquired cognitive communication disorders

REFERENCE:

- College of Audiologists and Speech-Language Pathologists of Ontario (CASLPO) (2015) p.25

### K 2.2







N C

Cognitive communication therapy goals should be set collaboratively with the person with traumatic brain injury and their family and include activities that are functional and personally relevant. (INESSS-ONF, 2015)

REFERENCE:

- Finch et al. (2015)

## k2 – Cognitive Communication Rehabilitation

<p><b>K 2.3</b></p> <p></p>	<p>A reliable Yes/No response in verbal and non-verbal individuals with traumatic brain injury should be established as soon as possible. This may be facilitated by consistent training and environmental enrichments. (INESSS-ONF, 2015)</p> <p>REFERENCES:</p> <ul style="list-style-type: none"> <li>- Barreca et al. (2003)</li> <li>- ERABI Module 7 - Cognitive-Communication Treatments, p.33</li> </ul>
<p><b>K 2.4</b></p> <p></p>	<p>Individuals with severe communication disability following traumatic brain injury should be provided with and trained in the use of appropriate alternative and augmentative communication aids by suitably trained clinicians.</p> <p>(Adapted from INCOG 2014, Cognitive Communication 6, p. 357)</p>
<p><b>K 2.5</b></p> <p></p>	<p>Social skills training should be offered to address interpersonal and pragmatic conversational skills problems in individuals with traumatic brain injury. (INESSS-ONF, 2015)</p> <p>REFERENCES:</p> <ul style="list-style-type: none"> <li>- Dahlberg et al. (2007)</li> <li>- McDonald et al. (2008)</li> </ul>
<p><b>K 2.6</b></p> <p></p>	<p>A cognitive communication rehabilitation program for individuals with traumatic brain injury should provide the opportunity to rehearse communication skills in situations appropriate to the context in which the person will live, work, study and socialize.</p> <p>(INCOG 2014, Cognitive Communication 4, p. 357)</p>
<p><b>K 2.7</b></p> <p></p>	<p>Intervention for social communication for individuals with traumatic brain injury should include role playing to improve a variety of social communication skills as well as self-concept and self-confidence in social communications. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"> <li>- Dahlberg et al. (2007)</li> </ul>
<p><b>K 2.8</b></p> <p></p>	<p>Clinicians should consider group therapy as an appropriate context for social skills training when social communication impairments exist post traumatic brain injury. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"> <li>- Braden et al. (2010)</li> </ul>

# L

# Dysphagia and Nutrition

## L1- Assessment of Swallowing (Dysphagia)

### L 1.1



Individuals with traumatic brain injury should be referred in a timely fashion to an appropriately trained and certified professional for a complete assessment of swallowing function when they present with one or more of the following risk factors for aspiration post-injury:

- Presence of a tracheostomy
- Poor cognitive functioning
- Hypoactive gag reflex
- Reduced pharyngeal sensation
- Brainstem involvement
- Difficulty swallowing oral secretions
- Coughing / throat clearing or wet/gurgly voice quality after swallowing water
- Choking more than once while drinking 50 ml of water
- Weak voice and cough
- Wet-hoarse voice quality
- Recurrent lower respiratory infections
- Unexplained low-grade fever or leukocytosis
- Immunocompromised state

(INESSS-ONF, 2015)

REFERENCE:

- [ERABI Module 5 - Dysphagia & Nutritional Interventions, p.21-22, 5.6.4, table 5.10](#)

### L 1.2



Instrumental assessment (videofluoroscopic modified barium swallow [VMBS]) of dysphagia in post traumatic brain injury (TBI) individuals should be considered when:

- Effectiveness of compensatory strategies and techniques for safe swallowing is being evaluated
- Bedside assessment indicates possible pharyngeal stage problems (which would potentially include the aspiration of food and fluid into the lungs)
- The risks of proceeding on the basis of the bedside assessment outweigh the possible benefits (the person with TBI is at very high risk of choking or aspiration if fed orally)
- The bedside assessment alone does not enable a sufficiently robust clinical evaluation to permit the development of an adequate plan for swallowing treatment

(Adapted from SIGN 2013, 7.2.1, p. 30)

## L1- Assessment of Swallowing (Dysphagia)

### L 1.3



For individuals with traumatic brain injury (TBI) who are cognitively and physically able to tolerate it, videofluoroscopic modified barium swallow (VMBS) or modified barium swallow (MBS) studies should be used as a tool to assist in dysphagia management and identification of aspiration. (INESSS-ONF, 2015)

Note: Aspiration can be seen in 30 to 50% of individuals with dysphagia post TBI.

- Silent aspiration is not uncommon and requires videofluoroscopic modified barium swallow (VMBS) imaging studies to detect.
- Aspiration is more common in more severe brain injuries.

REFERENCE:

- [ERABI Module 5 - Dysphagia & Nutritional Interventions, p.21-22, 5.6.4, table 5.10](#)

### L 1.4



Individuals with traumatic brain injury who are tracheotomised and/or ventilator-dependent should have an assessment by an appropriately-trained and certified professional to determine appropriateness for Passy Muir Valve placement or capping of trachea tube in preparation for swallowing assessment to optimize swallow function. (INESSS-ONF, 2015)

REFERENCE:

- [ERABI Module 5 - Dysphagia & Nutritional Interventions, p.38, 5.6.8](#)

## L2 – Management of Swallowing (Dysphagia)

### L 2.1



Individuals with traumatic brain injury, and particularly those with dysphagia, should have access to specialized oral and dental care. Serial assessment and meticulous oral and dental care should be undertaken during both the acute and rehabilitation stages post brain injury. (INESSS-ONF, 2015)

Note: Individuals should be provided with thorough oral care as a preventative treatment as defined by:

- Oral care prior to each meal
- Oral care that includes teeth, tongue, lips, buccal mucosa, and palate
- Oral care done more frequently if individual is on a free water protocol

A dentist or dental hygienist should be consulted as needed.

REFERENCE:

- [ERABI Module 5 - Dysphagia & Nutritional Interventions, p.27](#)

### L 2.2



Individuals with traumatic brain injury requiring enteral feeding should be converted from nasogastric feeding to gastrostomy feeding as soon as possible if the patient's condition allows, as the risk of developing pneumonia is higher among ventilated individuals fed by a nasogastric tube than among those fed with a gastrostomy tube. (INESSS-ONF, 2015)

REFERENCE:

- [ERABI Module 5 - Dysphagia & Nutritional Interventions, p.50, 5.8.5](#)

### L 2.3






The dysphagia intervention plan for individuals with traumatic brain injury should incorporate an interdisciplinary approach and consider positioning, feeding strategies, medical status, pharmacological profile, cognitive impairments, behaviour, comfort and nutritional status. (INESSS-ONF, 2015)





REFERENCE:

- College of Audiologists and Speech-Language Pathologists of Ontario (CASLPO) (2015)







## L2 – Management of Swallowing (Dysphagia)

 <p><b>L 2.4</b></p>	<p>Where possible, it is recommended that individuals with traumatic brain injury should be encouraged to self-feed. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"><li>- <a href="#">ERABI Module 5 - Dysphagia &amp; Nutritional Interventions, p.27, 5.5.1, table 5.13</a></li></ul>
 <p><b>L 2.5</b></p>	<p>To reduce the risk of aspiration pneumonia, education regarding proper oral care should be provided to the person with traumatic brain injury, healthcare professionals and family members. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"><li>- <a href="#">ERABI Module 5 - Dysphagia &amp; Nutritional Interventions, p.27, Table 5.13</a></li></ul>
 <p><b>L 2.6</b></p>	<p>Education on dysphagia, safe swallowing and safe feeding should be provided to individuals with traumatic brain injury (TBI), their family and caregivers. Additional focus should be placed on how cognitive impairments resulting from TBI can impact safe swallowing (e.g., impulsivity, neglect, verbosity, distractibility, fatigue, etc.). (INESSS-ONF, 2015)</p>

## L3 – Assessment and Management of Nutrition

 <p><b>L 3.1</b></p>	<p>All individuals with traumatic brain injury should have their nutrition and hydration status assessed. Nutritional interventions should be initiated as soon as the condition of the patient allows it in order to prevent undernutrition and malnutrition. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"><li>- <a href="#">ERABI Module 5 - Dysphagia &amp; Nutritional Interventions, p.38</a></li></ul>
 <p><b>L 3.2</b></p>	<p>Where appropriate, a professional trained in low-risk feeding strategies should provide feeding assistance or supervision to individuals with traumatic brain injury. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"><li>- <a href="#">ERABI Module 5 - Dysphagia &amp; Nutritional Interventions, p.28, Table 5.14</a></li></ul>
 <p><b>L 3.3</b></p>	<p>Enteral nutrition and parenteral nutrition are recommended, as they have been shown to be effective in providing an increase in calories to individuals with traumatic brain injury. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"><li>- <a href="#">ERABI Module 5 - Dysphagia &amp; Nutritional Interventions, p.42, 5.8.1</a></li></ul>
 <p><b>L 3.4</b></p>	<p>Total parenteral nutrition (TPN) is recommended and can be safely administered without causing serum hyperosmolality or influencing intracranial pressure levels (ICP) or ICP therapy in individuals with traumatic brain injury. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"><li>- <a href="#">ERABI Module 5 - Dysphagia &amp; Nutritional Interventions, p.42, 5.8.1</a></li></ul>


## L3 – Assessment and Management of Nutrition

<p><b>L 3.5</b></p> <p></p>	<p>Early enhanced enteral nutrition is recommended, when appropriate, to reduce the incidence of infection, reduce ventilator dependency and ICU stay, improve hormonal profile and potentially contribute to better outcomes of individuals with traumatic brain injury. (INESSS-ONF, 2015)</p> <p>Note: The diet should be started within the first 24 to 48 hours after admission, if the patient is hemodynamically stable. It should be withheld if high catecholamine doses are administered, alone or in combination with fluid or blood volumes, to restore cell infusion. (this note corresponds to level of evidence C)</p> <p>REFERENCES:</p> <ul style="list-style-type: none"> <li>- <a href="#">ERABI Module 5 - Dysphagia &amp; Nutritional Interventions, p.47, 5.8.2</a></li> <li>- McClave et al. (2016)</li> </ul>
<p><b>L 3.6</b></p> <p></p>	<p>Initiating enteral feeding for individuals with traumatic brain injury at goal rate is recommended to increase the percentage of prescribed energy and protein actually received. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"> <li>- <a href="#">ERABI Module 5 - Dysphagia &amp; Nutritional Interventions, p.48, 5.8.3</a></li> </ul>
<p><b>L 3.7</b></p> <p></p>	<p>Metoclopramide has not been shown to be effective as a gastric emptying aid and SHOULD NOT be used in individuals with traumatic brain injury. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"> <li>- <a href="#">ERABI Module 5 - Dysphagia &amp; Nutritional Interventions, p.51, 5.8.6</a></li> </ul>
<p><b>L 3.8</b></p> <p></p>	<p>Individuals with traumatic brain injury (TBI) should be screened for zinc deficiencies. If needed, zinc supplementation should be considered to promote neurological recovery post TBI. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"> <li>- <a href="#">ERABI Module 5 - Dysphagia &amp; Nutritional Interventions, p.52, 5.9.1</a></li> </ul>
<p><b>L 3.9</b></p> <p></p>	<p>High nitrogen feedings of approximately 2 g protein/kg is recommended to restore the substantial nitrogen losses that occur post traumatic brain injury.(INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"> <li>- <a href="#">ERABI Module 5 - Dysphagia &amp; Nutritional Interventions, p.55, 5.8.3</a></li> </ul>
<p><b>L 3.10</b></p> <p></p>	<p>Supplementation of branched-chain amino acids (BCAAs) in individuals following traumatic brain injury is recommended to enhance recovery of cognitive function, without negatively effecting tyrosine and tryptophan concentrations. (INESSS-ONF, 2015)</p> <p>Note: Availability of BCAA supplements may be an issue in Canada.</p> <p>REFERENCE:</p> <ul style="list-style-type: none"> <li>- <a href="#">ERABI Module 5 - Dysphagia &amp; Nutritional Interventions, p.56, 5.9.4</a></li> </ul>


# M




## Motor Function and Control

### M1 – Motor Function and Control Assessment

- M 1.1**  
 A trained professional with neurological expertise should assess, design, implement and supervise therapy to improve the motor functions of individuals with traumatic brain injury. (Adapted from NZGG 2006, 6.1, p. 88)


### M2 – Motor Function and Control Rehabilitation


- M 2.1**  
 Any physical treatment approaches provided following traumatic brain injury should take into account any associated orthopaedic or musculoskeletal injuries. (Adapted from NZGG 2006, 6.1, p. 88)



- M 2.2**  
   Motor therapy programs for individuals with TBI should target the preservation of functional range of motion (ROM) in all phases of care post traumatic brain injury (in the absence of refractory intracranial hypertension), but particularly in the acute and subacute phases, to allow for future motor recovery, functional activities and positioning. Regardless of prognosis, potential for recovery may be adversely affected if contractures are allowed to develop. (INESSS-ONF, 2015)



REFERENCE:


- [ERABI Module 4 - Motor & Sensory Impairment Remediation](#)

- M 2.3**  
 Motor therapy programs should be adapted to accommodate the normal environment and activities of the person with traumatic brain injury as much as possible. (Adapted from NZGG 2006, 6.1, p. 88)

- M 2.4**  
 Strength and endurance training with the person with traumatic brain injury should be performed, within the context of functional tasks when possible. (Adapted from ABIKUS 2007, G54, p. 24)










- M 2.5**  
  Individuals with traumatic brain injury should be given opportunities to practise their motor skills outside of formal therapy. (ABIKUS 2007, G53, p. 24)

- M 2.6**  
  As postural control is an essential component of mobility and motor function, individuals with traumatic brain injury should be given the opportunity to experience upright positions regardless of their level of responsiveness or level of severity and recovery, provided they are medically stable. For example, progressive upright sitting or supported standing for head, neck and trunk control should be a part of the postural control interventions. (INESSS-ONF, 2015)

- M 2.7**  
 Individuals with traumatic brain injury with complex postural/seating needs should be referred to a specialized interdisciplinary team with expertise in specialized seating. (Adapted from ABIKUS 2007, G54, p. 24 and NZGG 2006, 6.1.1, p. 90)



## M2 – Motor Function and Control Rehabilitation

<p><b>M 2.8</b></p> <p></p>	<p>Specific repetitive training interventions to increase functions post traumatic brain injury are recommended, such as sit-to-stand, functional reaching and balance, and gross motor coordination of the lower extremities. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"> <li>- <a href="#">ERABI Module 4 - Motor &amp; Sensory Impairment Remediation, p.32, 4.4.2</a></li> </ul>
<p><b>M 2.9</b></p> <p></p>	<p>Either virtual-reality-based balance retraining program or a conventional balance retraining program can be used to improve balance post traumatic brain injury. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"> <li>- <a href="#">ERABI Module 4 - Motor &amp; Sensory Impairment Remediation, p.32, 4.4.2</a></li> </ul>
<p><b>M 2.10</b></p> <p></p>	<p>Gait re-education is recommended to improve mobility after traumatic brain injury. (Adapted from ABIKUS 2007, G54, p. 24)</p>
<p><b>M 2.11</b></p> <p></p>	<p>Partial body weight supported gait training does <b>NOT</b> provide any added benefit over conventional gait training in ambulation, mobility or balance following traumatic brain injury. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"> <li>- <a href="#">ERABI Module 4 - Motor &amp; Sensory Impairment Remediation, p.29, 4.4.1</a></li> </ul>
<p><b>M 2.12</b></p> <p></p>	<p>For individuals with traumatic brain injury who are unable to ambulate over ground, gait training with partial support with a harness and/or hydrotherapy should be considered. (INESSS-ONF, 2015)</p>
<p><b>M 2.13</b></p> <p></p>	<p>Functional fine motor control retraining activities should be considered to improve fine motor coordination after traumatic brain injury. (Adapted from AOTA 2009, p. 82)</p>
<p><b>M 2.14</b></p> <p></p>	<p>Constraint-induced therapy should be considered for individuals with traumatic brain injury who have upper extremity motor impairments with some active wrist and finger movements and can cognitively engage in the therapy. (Adapted from AOTA 2009, p. 82)</p>
<p><b>M 2.15</b></p> <p></p>	<p>The following therapies could be considered to improve upper and lower extremity motor and sensory impairments following traumatic brain injury:</p> <ul style="list-style-type: none"> <li>· Functional electrical stimulation</li> <li>· Contrast baths</li> <li>· Mirror therapy</li> <li>· Cycle ergometry with or without motor assistance depending on the person's level of functioning.</li> </ul> <p>(INESSS-ONF, 2015)</p>
<p><b>M 2.16</b></p> <p></p>	<p>A program must be in place to prevent shoulder trauma for individuals with traumatic brain injury with flaccid upper extremities. This includes bed positioning, arm support in sitting and use of a hemi arm sling for standing and transfers. (INESSS-ONF, 2015)</p>

## M2 – Motor Function and Control Rehabilitation

<p><b>M 2.17</b></p> <p><b>C</b></p>	<p>Orthoses should be individually fitted by a health professional or orthotist with expertise in traumatic brain injury. (Adapted from NZGG 2006, 6.1.1, p. 90)</p>
<p><b>M 2.18</b></p> <p><b>B</b></p>	<p>Casts, splints and passive stretching may be considered for individuals with traumatic brain injury in cases where contracture and deformity are progressive. (SIGN 2013, 4.2.1, p. 17)</p>
<p><b>M 2.19</b></p> <p><b>P A</b></p>	<p>Exercise training is recommended to promote cardiorespiratory fitness in individuals with traumatic brain injury. (Adapted from ABIKUS 2007, G54, p. 24)</p>

## M3 – Assessment of Spasticity

<p><b>M 3.1</b></p> <p><b>C</b></p>	<p>Individuals with traumatic brain injury with spasticity should be assessed and provided with a coordinated plan for interdisciplinary management including:</p> <ul style="list-style-type: none"> <li>• Identification and management of aggravating factors such as pain, bladder or bowel distention, skin irritation and infection</li> <li>• Use of specific treatment modalities such as serial casting or removable splints</li> <li>• Use of anti-spasticity medications (See section M4 for more details)</li> <li>• Rehabilitation interventions that consider a range of motion, flexibility and positioning routine.</li> </ul> <p>(Adapted from ABIKUS 2007, G63, p. 26)</p>
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## M4 – Management of Spasticity

<p><b>M 4.1</b></p> <p><b>P B</b></p>	<p>Botulinum neurotoxin therapy (BoNT) may be considered to reduce tone and deformity in individuals with traumatic brain injury with focal spasticity. (Adapted from SIGN 2013, 4.2.2, p. 17)</p>
<p><b>M 4.2</b></p> <p><b>C</b></p>	<p>Botulinum neurotoxin therapy (BoNT) for individuals with traumatic brain injury should be used in an interdisciplinary setting with physiotherapist / occupational therapist and orthotist inputs where appropriate. (Adapted from SIGN 2013, 4.2.2, p. 17)</p>
<p><b>M 4.3</b></p> <p><b>C</b></p>	<p>Oral baclofen, tizanidine or dantrolene sodium may be considered for treatment of spasticity in individuals with traumatic brain injury. (Adapted from SIGN 2013, 4.2.3, p. 18)</p> <p>Note: Physicians should consider and monitor the sedative and cognitive side effects when prescribing these medications.</p>
<p><b>M 4.4</b></p> <p><b>C</b></p>	<p>A trial of intrathecal baclofen for the treatment of severe spasticity in individuals with traumatic brain injury may be considered after other treatment options have been exhausted, i.e. antispasticity medications (e.g. baclofen, dantrolene, tizanidine, botulinum toxin), casting, splinting or stretching. The trial should be carefully monitored for possible complications, including pump malfunction. Consideration must also be given to the individual's ability to access ongoing follow-up, for example to get refills, in case of a malfunction or for troubleshooting. (Adapted from NZGG 2006, 6.1.1, p. 90)</p>

## M5 – Assessment for Assistive Technology

<b>M 5.1</b> <b>P</b> <b>C</b>	<p>Individuals with traumatic brain injury (TBI) should be assessed to determine whether equipment or adaptations could increase their safety, independence, communication and quality of life. This assessment should:</p> <ul style="list-style-type: none"><li>· Be conducted by professionals with expertise in these areas (TBI and assistive devices and technology)</li><li>· Be conducted on an individual basis and in the environment in which the equipment will be used.</li></ul> <p>(Adapted from NZGG 2006, 6.2, p. 107)</p>
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## M6 – Prescription of Assistive Technology

<b>M 6.1</b> <b>P</b> <b>C</b>	<p>The prescription of equipment for individuals with traumatic brain injury should take into account cognitive, communicative and behavioural deficits and how these may constrain the person's ability, or their family/caregivers' ability, to use the equipment safely and appropriately. Where this is in doubt, arrangements should be in place for regular review. (Adapted from ABIKUS 2007, G88, p. 31 and NZGG 2006, 6.2, p. 107)</p>
<b>M 6.2</b> <b>C</b>	<p>When an item of equipment has been identified as required for a person with traumatic brain injury, it should be provided as quickly as possible. If safety is at issue, it should be provided before the person is discharged to the community. (NZGG 2006, 6.2, p. 107)</p>
<b>M 6.3</b> <b>C</b>	<p>The person with traumatic brain injury and their family or caregivers should be trained in the safe and effective use of equipment. (NZGG 2006, 6.2, p. 107)</p>
<b>M 6.4</b> <b>C</b>	<p>The person with traumatic brain injury and their family or 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 the equipment should be reviewed on a regular basis and in accordance with the manufacturers' guidelines. (Adapted from ABIKUS 2007, G89, p. 31 and NZGG 2006, 6.2, p. 107)</p>
<b>M 6.5</b> <b>C</b>	<p>Individuals with traumatic brain injury should have timely provision of an appropriate wheelchair and suitable supportive seating package, with regular review of the seating system as their needs change. (Adapted from NZGG 2006, 6.1.1, p. 90)</p>
<b>M 6.6</b> <b>C</b>	<p>Walking or standing aids for individuals with traumatic brain injury should be considered only after a full assessment of the potential benefits and harms of the walking aid in relation to the individual's physical status and cognitive ability. (Adapted from SIGN 2013, 4.1.6, p. 16)</p>

# N

## Sensory Impairment

### N1 – Vision Assessment

**N 1.1**



Individuals with traumatic brain injury should be screened for visual impairment and/or perceptual deficits and, if present, should undergo rehabilitation to address the specific visual impairment/deficit. (Adapted from ABIKUS 2007, G55, p. 25)

**N 1.2**



Individuals with traumatic brain injury with any visual impairment/deficit should be assessed by a team which includes, but is not limited to:

- Ophthalmologists
- Orthoptists where there are problems with eye movement/double vision
- Professionals with expertise in rehabilitation for the visually impaired

(Adapted from NZGG 2006, 6.1.4, p. 95)

### N2 – Management of Vision Impairment

**N 2.1**



All individuals with traumatic brain injury who present with persistent visual neglect or field defects should be offered specific retraining strategies. (Adapted from NZGG 2006, 6.1.4, p. 95)

**N 2.2**



Visual feedback force training should be used with individuals with traumatic brain injury who present tracking and transfer deficits. (INESSS-ONF, 2015)

REFERENCE:

- [ERABI Module 4 - Motor & Sensory Impairment Remediation, p.11, 4.1.3](#)

### N3 – Assessment of Vestibular Function

**N 3.1**



Individuals with traumatic brain injury should be screened, and if needed, formally assessed for vestibular dysfunction and, if present, should undergo a vestibular retraining program. The screening should be conducted by a professional specializing in vestibular function. (Adapted from ABIKUS 2007, G59, p. 25)



# Fatigue and Sleep Disorders

## 01 – Assessment of Fatigue and Sleep



**O 1.1**

All individuals who have sustained a traumatic brain injury should be assessed for fatigue and sleep disorders and offered appropriate treatment. (INESSS-ONF, 2015)

REFERENCE:

- [ERABI Module 15 - Fatigue and Sleep Disorders](#)

**O 1.2**



Clinicians should consider the possibility of sleep disorders related to traumatic brain injury as a cause of cognitive and other behavioural changes. (Adapted from ABIKUS 2007, G13, p. 18)

## 02 – Management of Fatigue and Sleep



**O 2.1**

Non-pharmacological interventions should be considered in the treatment of fatigue and sleep disorders for individuals with traumatic brain injury. Interventions may include: cognitive behaviour therapy (CBT) [for insomnia], light therapy, regular exercise, energy conservation strategies and sleep hygiene. (INESSS-ONF, 2015)

REFERENCE:

- [ERABI Module 15 - Fatigue and Sleep Disorders, p.16-19](#)

**O 2.2**



Consider use of melatonin 2–5 mg for insomnia following traumatic brain injury. (INESSS-ONF, 2015)

REFERENCES:

- Shekleton et al. (2010)
- Kemp et al. (2004)
- Ponsford et al. (2012)
- Colantonio et al. (2010)
- Glassner et al. (2013)

**O 2.3**



Consider use of trazodone 25–100 mg for insomnia post traumatic brain injury. (INESSS-ONF, 2015)

REFERENCE:

- Larson and Zollman (2010)

**O 2.4**



Benzodiazepines (lorazepam) and other non-benzodiazepine hypnotic (zopiclone) medications should be considered as last resort for the treatment of sleep disorders in individuals with traumatic brain injury, and it should be prescribed for no longer than 7 days. (INESSS-ONF, 2015)

REFERENCES:

- [ERABI Module 15 - Fatigue and Sleep Disorders, p.22, 15.4.3](#)
- Li Pi Shan and Ashworth (2004)
- Kemp et al. (2004)
- Aton et al. (2009)

## 02 – Management of Fatigue and Sleep

**O 2.5**



Consider short-term treatment with methylphenidate to reduce excess daytime sleepiness in individuals with traumatic brain injury. (INESSS-ONF, 2015)

REFERENCE:

- [ERABI Module 15 - Fatigue and Sleep Disorders, p.21, 15.4.2](#)

# P

## Pain and Headaches

### P1 – Assessment of Pain and Headaches

**P 1.1**



Pain should always be considered if a person with traumatic brain injury presents agitation or has cognitive/communication issues, non-verbal psychomotor restlessness or worsening spasticity, with particular attention paid to non-verbal signs of pain (e.g., grimacing). (ABIKUS 2007, G73, p. 27)

### P2 – Management of Pain and Headaches

**P 2.1**



Rehabilitation programs for individuals with traumatic brain injury should have pain management protocols in place, which include:

- Regular review and adjustment mechanisms
- Handling, support and pain relief modalities appropriate to the person's needs
- Education of healthcare professionals and caregivers about appropriate handling of paretic upper limbs during transfers, hypersensitivity and neurogenic pain

(Adapted from ABIKUS 2007, G74, p. 27)

**P 2.2**



Cognitive behaviour therapy (CBT) can be considered to reduce pain symptoms in individuals with post-traumatic headaches. (INESSS-ONF, 2015)

REFERENCE:

- [ERABI Module 4 - Motor & Sensory Impairment Remediation, p.55, 4.7.3.2](#)

**P 2.3**



Biofeedback can be considered to reduce pain symptoms in individuals with post-traumatic headaches. (INESSS-ONF, 2015)

REFERENCE:

- [ERABI Module 4 - Motor & Sensory Impairment Remediation, p.54, 4.7.3.1](#)

**P 2.4**



Pregabalin may be considered for reducing central neuropathic pain caused by injuries to the brain or spinal column. (INESSS-ONF, 2015)

REFERENCE:

- [ERABI Module 4 - Motor & Sensory Impairment Remediation, p.58, 4.7.4.1](#)

# Q

## Psychosocial/Adaptation Issues

### Q1 – Psychosocial/Adaptation Issues

<p><b>Q 1.1</b></p> <p><b>P</b> <b>N</b> <b>C</b></p>	<p>Rehabilitation programs aimed at improving social adaptation and a sense of well-being after traumatic brain injury should actively encourage physical exercise, leisure activities, self-regulation, coping skills, and participation in social support groups. (INESSS-ONF, 2015)</p>
<p><b>Q 1.2</b></p> <p><b>P</b> <b>N</b> <b>C</b></p>	<p>Participation in personally relevant and meaningful productive activities, including work, should be included as early as possible in the individualized treatment planning of the person with traumatic brain injury, while considering the person’s actual capacities. (INESSS-ONF, 2015)</p>
<p><b>Q 1.3</b></p> <p><b>P</b> <b>C</b></p>	<p>A discussion about sexuality should be carried out with individuals following traumatic brain injury. The discussion should be initiated by an appropriately trained clinician and should cover the following aspects of sexuality:</p> <ul style="list-style-type: none"> <li>· Physical aspects (e.g., positioning, sensory deficits, erectile dysfunction, drugs, disruption to menstrual cycle)</li> <li>· Psychological aspects (e.g., communication, fears, altered roles, disinhibition, threats to safety, and sense of attractiveness)</li> </ul> <p>(Adapted from NZGG 2006, 6.5, p. 113)</p>
<p><b>Q 1.4</b></p> <p><b>N</b> <b>C</b></p>	<p>Intervention and education about sexuality in individuals with traumatic brain injury should take into account cultural identity, gender, age, sex and sexual orientation. (INESSS-ONF, 2015)</p>

# R

## Neurobehaviour and Mental Health

### R1 – Neurobehavioural Assessment

<p><b>R 1.1</b></p> <p><b>P</b> <b>C</b></p>	<p>During the subacute phase of traumatic brain injury, if the neurobehavioural status of the individual is deteriorating or not progressing as expected, an assessment by a licensed specialist should be made to differentiate neurobehavioural difficulties from symptoms of a comorbid illness or medication side effects. (Adapted from INCOG 2014, Assess 7, p. 298)</p> <p>Note: Comorbid illness may include seizures, mood and anxiety disorders, personality disorders, metabolic disorders, medication side effects, attention issues, hearing impairment, communication impairment and substance abuse.</p>
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## R1 – Neurobehavioural Assessment

<p><b>R 1.2</b></p> <p><b>P</b> <b>C</b></p>	<p>In general, an assessment of neurobehavioural issues following traumatic brain injury must address pre-injury vulnerability factors, injury-related factors and postinjury factors. (Adapted from INCOG 2014, Assess 6, p.297)</p> <p>Note:</p> <p><b>Pre-injury vulnerability factors include:</b> Prior medical/neurological conditions, mental health disorders, substance use disorders, temperamental/personality factors, cognitive/intellectual ability, academic/vocational function, psychosocial circumstances</p> <p><b>Injury-related factors include:</b> Nature of injury (i.e., severity, focal vs. diffuse), cerebral involvement, anatomic injury location, extent of secondary injury, co-occurring extracranial injury</p> <p><b>Post-injury factors include:</b> Psychological response / coping style, cognitive status, social/economic changes, new-onset mental health disorders, medical conditions (such as seizures, sensorimotor changes, endocrine dysfunction, pain, sleep/wake disturbance), medication effects</p>
<p><b>R 1.3</b></p> <p><b>N</b> <b>C</b></p>	<p>Clinicians should carefully define and characterize the presenting neurobehavioural issue through a combination of diagnostic interviews (including close relatives and the health care team) and direct observation of the person with traumatic brain injury. (INESSS-ONF, 2015)</p>
<p><b>R 1.4</b></p> <p><b>P</b> <b>B</b></p>	<p>Any behavioural management plan for individuals with traumatic brain injury must include a consideration of the precipitating factors or triggers possibly leading to the behaviour and reinforcing events. (Adapted from ABIKUS 2007, G24, p. 20)</p>
<p><b>R 1.5</b></p> <p><b>P</b> <b>C</b></p>	<p>Individuals who have sustained a traumatic brain injury after a known or suspected incident of self-harm or a suicide attempt should have a risk assessment performed and should be referred as appropriate. (Adapted from NZGG 2006, 3.11, p. 66)</p>

## R2 – Neurobehavioural Interventions

<p><b>R 2.1</b></p> <p><b>C</b></p>	<p>At any point throughout the continuum of care, individuals with traumatic brain injury and significant behavioural problems that interfere with daily functions should be provided with access to specialized behavioural management services and interventions to assist in the management of their behavioural difficulties, including substance abuse. (Adapted from ABIKUS 2007, G19, p. 19)</p>
<p><b>R 2.2</b></p> <p><b>P</b> <b>C</b></p>	<p>In the case of individuals with significant behavioural problems following traumatic brain injury, especially those with a tendency to wander, the interdisciplinary team should develop an integrated approach to manage behaviour and refer to specialist behavioural management services when necessary and where available. (Adapted NZGG 2006, 6.1.7, p. 103)</p>

## R3 – Management of Sexual Behaviour

<p><b>R 3.1</b></p> <p><b>C</b></p>	<p>Family, caregivers, and healthcare professionals should be provided with education and training on change management strategies regarding persistent inappropriate sexual behaviour following traumatic brain injury and how to avoid inadvertently reinforcing this behaviour. (Adapted from NZGG 2006, 6.5, p. 113)</p>
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## R4 – Assessment of Mood and Depression

### R 4.1



Individuals with traumatic brain injury (TBI) should be screened on a regular basis for depression using an appropriate screening tool. Depression screening tools should not be used as the sole indication for initiation of treatment. Diagnosis should always involve a full assessment as well as the clinical judgment of a specialist experienced in managing individuals with TBI. (Adapted from ABIKUS 2007, G72, p. 27)

## R5 – Management of Mood and Depression

### R 5.1



Individuals with traumatic brain injury who have been diagnosed with a depressive disorder should receive appropriate treatment, which can consist of non-pharmacological treatments including psychological intervention/counselling and exercise. (Adapted from ABIKUS 2007, G70, p. 27)

### R 5.2



Mindfulness-based cognitive therapy, adapted for brain injury, should be considered for individuals with traumatic brain injury and depressive symptoms. (INESSS-ONF, 2015)

#### REFERENCES:

- Bedard et al. (2014)
- [ERABI Module 8 - Mental Health Issues, p.18, 8.2.4](#)

### R 5.3



Teaching coping skills in groups to reduce depressive symptoms should be considered for individuals with traumatic brain injury who have good awareness of their difficulties. (INESSS-ONF, 2015)

#### REFERENCE:

- [ERABI Module 8 - Mental Health Issues, p.18, 8.2.4](#)

### R 5.4



Cognitive behaviour therapy (CBT) should be considered for individuals with depressive symptoms after traumatic brain injury, in individual, group, and modified telephone-based formats. (INESSS-ONF, 2015)

#### REFERENCES:

- Arundine et al. (2012)
- Bradbury et al. (2008)

## R6 – Medication for Depression

### R 6.1



Given their favourable side-effect profile, selective serotonin reuptake inhibitors (SSRIs) are recommended as a first-line treatment for depression following traumatic brain injury (TBI). A limited body of evidence supports the efficacy of sertraline (starting at 25 mg; aiming for 50–200 mg/day) and citalopram (starting at 10 mg; aiming for 20–40 mg/day). (INESSS-ONF, 2015)

Note: Depression after TBI is amenable to pharmacologic interventions and such treatment may alleviate not only the mood disturbance but also be of benefit for other symptoms.

If selective serotonin reuptake inhibitors (SSRIs) have been trialed and are not effective, or have produced unwanted side effects or drug interactions, the individual with TBI should be referred for review to a psychiatrist with expertise in treating individuals with TBI.

#### REFERENCE:

- [ERABI Module 8 - Mental Health Issues, p.18, 8.2.3](#)

## R6 – Medication for Depression

### R 6.2



Stimulants such as methylphenidate may be considered for depression after traumatic brain injury over the shorter term; they may also be used to augment a partial response to selective serotonin reuptake inhibitors (SSRIs), especially in the setting of cognitive impairments, apathy, and/or fatigue. (INESSS-ONF, 2015)

REFERENCE:

- Lee et al. (2005)

### R 6.3



Consider use of tricyclic antidepressants (TCAs) (desipramine) as a third-line option for depression following traumatic brain injury, although possible reduced efficacy and a higher risk of side effects (e.g., seizures) may limit their use. (INESSS-ONF, 2015)

REFERENCE:

- Wroblewski et al.(1996)

## R7 – Therapy for Anxiety

### R 7.1



Cognitive behaviour therapy (CBT) is recommended to reduce anxiety post traumatic brain injury. (INESSS-ONF, 2015)

REFERENCES:

- [ERABI Module 8 - Mental Health Issues, p.18, 8.2.3](#)
- Arundine et al. (2012)
- Bradbury et al. (2008)

## R8 – Medication for anxiety

### R 8.1



Given their favourable tolerability and broad utility, selective serotonin reuptake inhibitors (SSRIs) may be considered for anxiety treatment of individuals with traumatic brain injury (TBI). (INESSS-ONF, 2015)

Note: There is a lack of research concerning medication treatment of anxiety disorders after TBI; however, much evidence exists supporting their treatment in the non-TBI population.

### R 8.2



The use of benzodiazepines as first-line therapy for anxiety in individuals with traumatic brain injury (TBI) is **NOT** recommended due to potential effects on arousal, cognition, and motor coordination. The potential for abuse/dependency associated with these agents is also of concern, given the elevated rates of pre-injury substance use disorders observed among individuals with TBI. Nonetheless, short-term use of these agents may be helpful during periods of crisis or acute distress. (INESSS-ONF, 2015)

REFERENCE:

- Waldron-Perrine et al. (2008)

## R9 – Medication for Psychosis

### R 9.1



The use of second generation neuroleptics is recommended for the treatment of psychosis as they are associated with fewer extrapyramidal symptoms (EPS) than first generation neuroleptics and exert their effects at sites other than the D2 receptor. (Adapted from NGWG 2006, p. 1475)

Note: First generation neuroleptics have also been associated with greater impact on neuronal recovery. The ongoing need for antipsychotic medications should be periodically reassessed, and ongoing monitoring of weight, metabolic parameters, and late-emerging extrapyramidal symptoms is required. As all neuroleptics lower the seizure threshold to varying degrees, an initial trial with an anticonvulsant should be considered when heightened risk of seizures is of substantial concern.

## R10 – Medication for Agitation/Aggression

### R 10.1



For severe acute life threatening agitation and aggression that threatens staff or patient safety, the use of neuroleptic medications or intramuscular benzodiazepine can be considered. (INESSS-ONF, 2015)

REFERENCE:

- [ERABI Module 12 - Neuropharmacology, p.25;36;38](#)

### R 10.2



For severe agitation and aggression that threatens staff or patient safety, consider the use of oral neuroleptic medications (while taking into consideration the onset of action). Second generation neuroleptic medications like quetiapine, ziprasidone, olanzapine and risperidone are preferred as older agents may have more side effects though methotrimeprazine have been used with limited side effects. (INESSS-ONF, 2015)

REFERENCES:

- Chew and Zafonte (2009)
- Bhatnagar et al. (2016)
- Elovic et al. (2008)

### R 10.3



Either propranolol or pindolol is recommended for the treatment of aggression after traumatic brain injury, particularly for individuals in post-traumatic amnesia (PTA). Studies have 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, if there are no medical contraindications. (INESSS-ONF, 2015)

REFERENCE:

- [ERABI Module 8 - Mental Health Issues, p.37-38](#)

### R 10.4



The use of valproate (750–2250 mg/day and/or carbamazepine (200–1200 mg/day) to reach therapeutic range should be considered as an option for the treatment of aggression in individuals with traumatic brain injury, particularly those who have a concomitant seizure disorder. (Adapted from NGWG 2006, p.1492)

### R 10.5









The use of amantadine 100 mg bid or methylphenidate can be considered for individuals with traumatic brain injury when impaired arousal and attention is suspected as a factor in agitation. (INESSS-ONF, 2015)



REFERENCES:

- Hammond et al. (2014)
- Hammond et al. (2015)



## R10 – Medication for Agitation/Aggression

<p><b>R 10.6</b></p> <p> </p>	<p>The use of sertraline may be considered as an option for the treatment of individuals with moderate agitation and irritability following traumatic brain injury. The use of other selective serotonin reuptake inhibitors (SSRIs) may be considered as an alternative if sertraline is not tolerated. (INESSS-ONF, 2015)</p> <p>REFERENCES:</p> <ul style="list-style-type: none"><li>- <a href="#">ABIKUS (2007), G29, p.21</a></li><li>- Kant et al. (1998)</li></ul>
<p><b>R 10.7</b></p> <p> </p>	<p>Tricyclic antidepressants may be considered as a third-line option for the treatment of aggression following traumatic brain injury, particularly for those who have an associated sleep-wake disorder. When used, nortriptyline or desipramine are preferable based upon their tolerability. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"><li>- Warden et al. (2006), p.1492</li></ul>
<p><b>R 10.8</b></p> <p> </p>	<p>The use of first generation neuroleptics and benzodiazepines to treat agitation or aggression in individuals with traumatic brain injury should be minimized, as these medications may slow recovery after brain injury and may have a negative effect on cognition. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"><li>- <a href="#">ABIKUS (2007),G15, p.19</a></li></ul>

## R11 – Medication for Bipolar Disorder/Mania

<p><b>R 11.1</b></p> <p> </p>	<p>The use of commonly used medications such as lithium, anticonvulsants and neuroleptics in the management of symptoms resembling bipolar disorder (i.e., mania and depressed mood) should be considered, although insufficient evidence supports or refutes their use in individuals with traumatic brain injury. Lithium requires careful monitoring, as side effects may limit its use in this population. (INESSS-ONF, 2015)</p> <p>REFERENCES:</p> <ul style="list-style-type: none"><li>- <a href="#">ERABI Module 12 - Neuropharmacology, p.25;36;38</a></li><li>- Chew and Zafonte (2009)</li></ul>
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## R12 – Family Education in Neurobehavioural Issues

<p><b>R 12.1</b></p> <p> </p>	<p>The family and key members of the network of the affected person should be provided with education about potential causes for behaviour and emotional disorders after traumatic brain injury, possible antecedents and triggers, appropriate management strategies, as well as possible side effects of medication. The family should receive timely information in writing on how to manage behaviour and emotions and should be invited to play a role in providing feedback and behavioural data. (INESSS-ONF, 2015)</p>
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# S

# Substance Use Disorders

## S1 – Assessment of Substance Use Disorders

<p><b>S 1.1</b></p> <p><b>P</b> <b>N</b> <b>C</b></p>	<p>All individuals with traumatic brain injury should be screened for history of substance use, intoxication at time of injury, and current substance use. An appropriate screening tool should be used as indicated along the continuum of treatment. Positive screening should lead to full assessment by a qualified professional. (INESSS-ONF, 2015)</p> <p>REFERENCE :</p> <ul style="list-style-type: none"> <li>- Ponsford et al. (2007)</li> </ul>
<p><b>S 1.2</b></p> <p><b>C</b></p>	<p>Education and training should be provided to healthcare professionals in drug and alcohol misuse programs in relation to traumatic brain injury, its sequelae, and effects on drug and alcohol use. (Adapted from NZGG 2006, 14.3, p. 170)</p>

## S2 – Management of Substance Use Disorders

<p><b>S 2.1</b></p> <p><b>N</b> <b>C</b></p>	<p>Management for co-occurring substance use disorders and brain injury should be concurrent (not sequential). Substance-use-related goals and interventions should be integrated within the traumatic brain injury rehabilitation plans. (INESSS-ONF, 2015)</p>
<p><b>S 2.2</b></p> <p><b>N</b> <b>C</b></p>	<p>Substance use should not be an exclusionary criterion for traumatic brain injury rehabilitation. Interventions should be maintained, while aiming at reducing harm and ensuring the safety of the person who continues to use substances. (INESSS-ONF, 2015)</p>
<p><b>S 2.3</b></p> <p><b>N</b> <b>B</b></p>	<p>Healthcare professionals should use treatment incentives to assist individuals with both traumatic brain injury and substance use disorder in order to effectively engage in intervention. (INESSS-ONF, 2015)</p> <p>REFERENCES:</p> <ul style="list-style-type: none"> <li>- Corrigan and Bogner (2007)</li> <li>- Corrigan et al. (2005)</li> </ul>
<p><b>S 2.4</b></p> <p><b>P</b> <b>N</b> <b>C</b></p>	<p>Secondary prevention of substance use disorders after traumatic brain injury (TBI) should be undertaken in the form of education and information. Materials should be provided to all individuals with TBI and their families in both written and verbal formats. This information should be provided in a timely manner, ideally beginning just after post-traumatic confusion has cleared, and continue across the continuum of care. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"> <li>- Corrigan (unknown year)</li> </ul>

# T

# Medical/Nursing Management

## T1 – Assessment of Continence

- T 1.1** Full assessment of bladder and bowel functions should be undertaken over a period of days following admission to rehabilitation. The physical, cognitive and emotional function of the person with traumatic brain injury should be considered. (Adapted from SIGN 2013, 4.4, p. 19)
- C**

## T2 – Management of Incontinence

- T 2.1** The rehabilitation plan for urinary incontinence following traumatic brain injury should include:
- A regular monitoring program
  - Strategies for alerting the caregivers to the person’s need to pass urine where there are communication problems
  - A toileting regimen based on reinforcement in cases of cognitive impairment
  - Bladder re-education
- (Adapted from NZGG 2006, 6.1.3, p. 93)
- P C**

- T 2.2** Individuals with traumatic brain injury with continence problems should not be discharged home **until** continence aids and services have been arranged at home and caregivers have been adequately prepared. (Adapted from NZGG 2006, 6.1.3, p. 93)
- P C**




- T 2.3** Anticholinergic medication for continence problems for individuals with traumatic brain injury should **only** be prescribed after demonstration of an overactive bladder. Use of urodynamic assessment is considered optimal.(Adapted from NZGG 2006, 6.1.3, p. 93)
- C**
- Note: Anticholinergic medications are associated with complications including memory and cognitive impairments.

- T 2.4** Intermittent catheterisation should be considered for use in individuals with traumatic brain injury who are shown to have an elevated post-micturition residual volume. (Adapted from NZGG 2006, 6.1.3, p. 93)
- C**







- T 2.5** Long-term catheters can be considered as part of a planned catheter management program for individuals with traumatic brain injury. Supra-pubic catheters should, however, be considered as a preferred alternative to long-term urethral catheters. (Adapted from NZGG 2006, 6.1.3, p. 93)
- C**

- T 2.6** In the case of constipation following traumatic brain injury, an active bowel management regimen should be instituted as soon as possible, which includes:
- Ensuring sufficient fluid intake
  - The use of natural laxatives, stimulants, or simple bulk laxatives
  - Exercise and standing, where possible
  - Avoiding medications which slow gut motility
  - Maximum privacy and comfort during defecation
  - Supported sitting up for defecation at the earliest safe opportunity, and at a regular time each day
  - Where the rectum is full but no spontaneous evacuation occurs, rectal stimulation may be used
- (Adapted from NZGG 2006, 6.1.3, p. 93)
- C**





## T2 – Management of Incontinence

<p><b>T 2.7</b></p> <p></p>	<p>Bladder and bowel management plans for individuals with traumatic brain injury should be developed with the full knowledge and support of the person’s primary caregiver. (Adapted from NZGG 2006, 6.1.3, p. 94)</p>
<p><b>T 2.8</b></p> <p> </p>	<p>Asymptomatic bacteriuria should only be treated with antibiotic therapy in exceptional circumstances following traumatic brain injury (i.e., pregnancy, pending urologic procedure, worsening cognitive status). (INESSS-ONF, 2015)</p> <p>REFERENCES:</p> <ul style="list-style-type: none"> <li>- Lin and Fajardo (2008)</li> <li>- Colgan et al. (2006)</li> </ul>

## T3 – Seizures

<p><b>T 3.1</b></p> <p></p>	<p>Acute seizures during rehabilitation following traumatic brain injury should be managed according to established protocols. (Adapted from ABIKUS 2007, G79, p. 28)</p>
<p><b>T 3.2</b></p> <p> </p>	<p>Anticonvulsants, particularly phenytoin and levetiracetam, are indicated to reduce the incidence of post-traumatic seizures in the first 7 days post-injury. Routine use of anticonvulsants to prevent late post-traumatic seizures after 7 days post-injury is not recommended. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"> <li>- Brain Trauma Foundation (2007)</li> </ul>
<p><b>T 3.3</b></p> <p>  </p>	<p>In the event that use of anticonvulsant medications is indicated in the acute and chronic phases of traumatic brain injury, consideration should be given to choosing medications with the most favourable side effect profiles, as these medications have significant neuropsychological and other side effects. (INESSS-ONF, 2015)</p> <p>Note: For example, phenytoin may have negative effects on cognitive performance and recovery, although phenytoin may still be considered a first-line drug for early seizures in the acute period in view of ease of administration and monitoring. Clinicians should be particularly vigilant for adverse cognitive side effects of anticonvulsant medications and not assume that these drugs are without risk of impairment of cognitive, behavioural, physical, and neuroendocrine function, as well as having potential negative impacts on long-term recovery.</p> <p>REFERENCE:</p> <ul style="list-style-type: none"> <li>- ERABI Module 10- Post-Traumatic Seizure Disorder, p.12, 10.4</li> </ul>

## T4 – Deep Vein Thrombosis

<p><b>T 4.1</b></p> <p>  </p>	<p>Venous thromboprophylaxis should be initiated as soon as medically appropriate following traumatic brain injury. (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"> <li>- Glassner et al. (2013)</li> </ul>
<p><b>T 4.2</b></p> <p></p>	<p>Low-molecular-weight heparin (LMWH) is preferred over unfractionated heparin (UFH) for venous thromboprophylaxis after traumatic brain injury (TBI). (Adapted from ABIKUS 2007, G77, p. 28)</p> <p>Note: Much of the evidence supporting this recommendation is derived from the trauma/medical literature not specifically focused on individuals with TBI.</p>

## T4 – Deep Vein Thrombosis

**T 4.3**

**B**

When pharmacological venous thromboprophylaxis is contraindicated or delayed after traumatic brain injury, physical methods (i.e., intermittent pneumatic compression stockings) should be utilized. (Adapted from ABIKUS 2007, G77, p. 28)

## T5 – Screening for Neuroendocrine Complications

**T 5.1**



Screening of the hypothalamic pituitary axis should occur at 3-6 months post traumatic brain injury (TBI) or when symptoms are suggestive of a hormonal imbalance or deficiency. Screening should include a.m. cortisol, serum glucose, thyroid hormone (Free T4), thyroid-stimulating hormone (TSH), prolactin, estrogen or a.m. testosterone (T), follicle-stimulating hormone (FSH), luteinizing hormone (LH) and insulin-like growth factor-1 (IGF-1). Clinicians should be aware that a low or normal thyroid-stimulating hormone (TSH) does not rule out pituitary insufficiency with thyroid hormone deficiency. (INESSS-ONF, 2015)

Note: Hypothalamic pituitary axis dysfunction is common post TBI and may vary in the acute, subacute or chronic phase. This dysfunction may affect the anterior pituitary system, the posterior pituitary, or both. Individuals with severe TBI commonly develop disorders of the anterior pituitary during the acute, subacute or chronic phase post-injury, which results in neuro-hormonal disturbances.

REFERENCES:

- [ERABI Module 9-Neuroendocrine Disorders, p.14](#)
- Sesnilo et al. (2007)

## T6 – Neuroendocrine Complications

**T 6.1**



Individuals with traumatic brain injury and hyponatremia should have an assessment of their hydration status, serum electrolytes with urinary electrolytes and sodium excretion. Restricting fluid intake and salt supplementation should be considered in managing the electrolyte disturbance in those with syndrome of inappropriate antidiuretic hormone secretion (SIADH) or hyponatremia due to cerebral salt wasting in individuals. (INESSS-ONF, 2015)

REFERENCES:

- [ERABI Module 9-Neuroendocrine Disorders, p.17](#)
- Sesnilo et al. (2007)

**T 6.2**



Individuals with traumatic brain injury (TBI) with an identified neuroendocrine abnormality on screening should be referred, where appropriate, to an endocrinologist familiar with this TBI population, particularly if stimulation testing may be required to further evaluate complex hormonal imbalance such as growth hormone (GH) deficiency and replacement. (INESSS-ONF, 2015)

REFERENCE:

- [ERABI Module 9-Neuroendocrine Disorders, p.30](#)

## T7 – Screening for Heterotopic Ossification

**T 7.1**



Individuals with traumatic brain injury (TBI), especially those with severe injury, should be regularly assessed for the possible presence of heterotopic ossification. The sites most frequently affected following TBI are the hips, elbows, shoulders and knees. (INESSS-ONF 2015)



## T7 – Screening for Heterotopic Ossification

<p><b>T 7.2</b></p> <p><b>B</b></p>	<p>Early diagnosis of heterotopic ossification following traumatic brain injury should involve a three-phase bone scan. (Adapted from ABIKUS 2007, G75, p. 28)</p>
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## T8 – Treatment of Heterotopic Ossification

<p><b>T 8.1</b></p> <p><b>C</b></p>	<p>Once heterotopic ossification (HO) has developed in individuals with traumatic brain injury, treatment should include etidronate and/or non-steroidal anti-inflammatory drugs. (Adapted from ABIKUS 2007, G75, p. 28)</p>
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<p><b>T 8.2</b></p> <p><b>P N C</b></p>	<p>Passive range-of-motion exercises following traumatic brain injury are important to maintain joint range of motion (ROM) and do not worsen heterotopic ossification (HO). ROM must be gentle and within available range, as aggressive ROM beyond the available joint range can exacerbate HO. (INESSS-ONF, 2015)</p>
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REFERENCE:

- ERABI Module 11- Heterotopic Ossification and Venous Thromboembolism post ABI, p.9, 11.3.1

<p><b>T 8.3</b></p> <p><b>C</b></p>	<p>Manipulation of joints under anaesthesia can be considered as a treatment to increase range of motion in individuals with heterotopic ossification (HO) following traumatic brain injury. (Adapted from ABIKUS 2007, G76, p. 28)</p>
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<p><b>T 8.4</b></p> <p><b>B</b></p>	<p>Surgical excision of heterotopic ossification (HO) should be considered at a later stage in individuals with traumatic brain injury. (Adapted from ABIKUS 2007, G75, p. 28)</p>
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## T9 – Principles of Medication Management (Neuropharmacology)

<p><b>T 9.1</b></p> <p><b>P N C</b></p>	<p>Pharmacological treatment of neurobehavioural / mental health symptoms following traumatic brain injury should be based upon individual factors and symptom severity and comorbidity; and will often represent only one component of a multimodal treatment strategy. (INESSS-ONF, 2015)</p>
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<p><b>T 9.2</b></p> <p><b>P N C</b></p>	<p>Specific target symptoms/behaviours should be clearly defined and monitored during pharmacological treatment following traumatic brain injury (TBI), along with expected treatment outcomes. The serial use of validated rating scales appropriate for TBI and other methods of objective assessment are recommended. (INESSS-ONF, 2015)</p>
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<p><b>T 9.3</b></p> <p><b>P N C</b></p>	<p>Careful drug selection and monitoring are required when initiating pharmacological interventions to minimize potential adverse effects on arousal, cognition, motivation and motor coordination following traumatic brain injury. Use of medications that target more than one brain-injury-related symptom/syndrome is recommended, if possible (e.g., one agent targeting both mood and insomnia, or headache and insomnia). (INESSS-ONF, 2015)</p>
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## T9 – Principles of Medication Management (Neuropharmacology)

<p><b>T 9.4</b></p> <p> </p>	<p>Individuals with traumatic brain injury and their surrogate decision makers should be made aware when use of medication is "off label" and the consent-to-treatment process should be modified accordingly. (INESSS-ONF, 2015)</p> <p>Note: The consent process should include discussion of the rationale with respect to target symptoms/syndrome, the published evidence for the selected treatment, side effects, risks, potential benefits, etc.</p>
<p><b>T 9.5</b></p> <p>  </p>	<p>The introduction of medications for individuals with traumatic brain injury should be started at the lowest effective dose and be titrated slowly upwards, based upon tolerability, clinical response and situational urgency. Drug trials should allow adequate duration and dosing. Therapeutic goals should be clearly established and serve as indicators for the efficacy. If those goals are not met, ending the use of medication must be considered. (INESSS-ONF, 2015)</p>
<p><b>T 9.6</b></p> <p></p>	<p>Serum drug levels in the person with traumatic brain injury should be monitored as necessary to prevent toxicity. (Adapted from NZGG 2006, 14.4.10. 3, p. 182)</p>
<p><b>T 9.7</b></p> <p> </p>	<p>Clinicians should avoid making more than one medication change at a time for a person with traumatic brain injury (i.e., when adding new medications or changing doses). Doing "one thing at a time" will enable more accurate assessment of drug benefits and potential adverse effects (when possible). (INESSS-ONF, 2015)</p> <p>REFERENCE:</p> <ul style="list-style-type: none"> <li>- Brain Trauma Foundation (2007) Section 8. Persistent Mental Health Disorders, Ref 8.7.c</li> </ul>
<p><b>T 9.8</b></p> <p> </p>	<p>Due to potential limits in self-awareness of the patient with traumatic brain injury, collaboration with family and/or significant others, if possible and accepted by the patient, may be useful to monitor the efficacy and side effects of treatment. (INESSS-ONF, 2015)</p>
<p><b>T 9.9</b></p> <p></p>	<p>Pharmacological treatment of neurobehavioural / mental health or other symptoms following traumatic brain injury should be used with caution and with the knowledge that studies suggest that many medications, including neuroleptics, anxiolytics, and anticonvulsants are associated with slowed recovery after brain injury. (Adapted from ABIKUS 2007, G15, p. 19)</p> <p>REFERENCES:</p> <ul style="list-style-type: none"> <li>- Bhullar et al. (2014)</li> <li>- Szafarski et al. (2014)</li> <li>- Bogner et al. (2015)</li> <li>- Bhatnagar et al. (2016)</li> <li>- Plantier and Luauté (2016)</li> </ul>
<p><b>T 9.10</b></p> <p></p>	<p>If the decision is made to prescribe medication to enhance arousal/awareness in a person with traumatic brain injury, a therapeutic trial (A-B-A design), should be employed, using a single agent at a time, with emphasis on formal monitoring to observe the impact of the medication. (Adapted from RCP 2013, Section 2; 2.8, p. 34)</p> <p>Note: A-B-A design refers to a specific type of research design in which there is a baseline period where no treatment is given and/or no variable is introduced (A), followed by a period in which the treatment or variable is introduced (B), and then a period in which the treatment is removed so the behaviour can be observed a second time (A). This way, behaviour can be measured before treatment, during treatment and once treatment is removed.</p>

## T9 – Principles of Medication Management (Neuropharmacology)

**T 9.11**



A person with traumatic brain injury with significant challenging behaviours may require a combination of non-pharmacological and pharmacological approaches for optimal treatment. If possible, a sequenced approach should be used to avoid confounding data and to determine effective components. (Adapted from NZGG 2006, 6.1.7, p. 103)

**T 9.12**



Physicians are directed to consult their funder's formulary for each medication under consideration to determine access to medication and eligibility for funding, as this varies by jurisdiction and funder, and some medications recommended in this guideline may not be funded by the insurer. (INESSS-ONF, 2015)

## NOTES



Many recommendations included in these guidelines have been adapted from already existing CPGs (see table below). New recommendations formulated by the expert panel have been identified with the letter "N" and referenced as INESSS-ONF, 2015.



**Fundamental Recommendations** are defined as the elements that rehabilitation programs/services need to have in place, in order to build the rest of the system properly. These are primarily for program managers and their leaders as they reflect the service conditions for optimal rehabilitation provision.



**Priority Recommendations** are clinical practices or processes deemed most important to implement and monitor during the course of rehabilitation for people having sustained a TBI. These practices are most likely to bring on positive outcomes for people with TBI.

### A PRIORITY Recommendation meets the following criteria:

- It addresses a clinical practice or process **identified as important to address by the targeted users of the CPG** during the survey process; and/or
- It is supported by strong evidence or strong expert consensus; and/or
- It was **ranked by the expert panel amongst the most important ones to consider or implement** within a specific topic area;
- **Its implementation is deemed important and feasible** by the development team (Scientific Committee) involved in the organization, delivery and monitoring of quality services for TBI in the province of Quebec and Ontario;
- Its implementation and, when possible, its impact on outcome, **can be measured**.

The guideline development team (Scientific Committee) strongly believes that implementation of the priority recommendations would be difficult without the fundamental recommendations in place first.

## INESSS-ONF Level of Evidence



Recommendation supported by at least 1 meta-analysis, systematic review, or randomized controlled trial of appropriate size with relevant control group.



Recommendation supported by cohort studies that at minimum have a comparison group, well-designed single subject experimental designs, or small sample size randomized controlled trials.



Recommendation supported primarily by expert opinion based on their experience, though uncontrolled case series without comparison groups that support the recommendations are also classified here.

## ORIGINAL GUIDELINES SOURCES

Authors	Year	Clinical Practice Guidelines
Neurobehavioral Guidelines Working Group (NGWG) (Warden et al.)	2006	Guidelines for the Pharmacologic Treatment of Neurobehavioral Sequelae of Traumatic Brain Injury
Acquired Brain Injury Knowledge Uptake Strategy (ABIKUS)	2007	ABIKUS Evidence Based Recommendations for Rehabilitation of Moderate to Severe Acquired Brain Injury
New Zealand Guidelines Group (NZGG)	2007	Traumatic Brain Injury: Diagnosis, Acute Management and Rehabilitation
American Occupational Therapy Association (AOTA) (Golisz)	2009	Occupational Therapy Practice Guidelines for Adults with Traumatic Brain Injury
Stergiou-Kita	2011	A Guideline for Vocational Evaluation Following Traumatic Brain Injury: A Systematic and Evidence-based Approach
Scottish Intercollegiate Guidelines Network (SIGN)	2013	Brain Injury Rehabilitation in Adults
Royal College of Physicians (RCP)	2013	Prolonged Disorders of Consciousness National Clinical Guidelines
INCOG Team (INCOG) (Bayley et al.)	2014	INCOG Recommendations for Management of Cognition Following Traumatic Brain Injury
INESSS-ONF	2015	Clinical Practice Guideline for the Rehabilitation of Adults with Moderate to Severe Traumatic Brain Injury

## REFERENCES

Complete references for the listed sources can found at [www.braininjuryguidelines.org](http://www.braininjuryguidelines.org) or [www.guidepratiqueTCC.org](http://www.guidepratiqueTCC.org)