# Use of Modified Brain Injury Guidelines (mBIG) in Ontario Emergency Departments

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# Table of Contents


Table of Contents ..... 2

Disclaimer ..... 3

Executive Summary ..... 4

Adult Modified Brain Injury Guideline (mBIG) –Adapted for Use in Ontario ..... 5

Appendix A – Ontario mBIG 2 Traumatic Subarachnoid Haemorrhage Sample Order Sets ..... 6

Appendix B – Ontario mBIG 2 Traumatic Subdural Hematoma (tSDH) Sample Order Sets ..... 8

Appendix C – Adult mBIG 1 ED Observation Algorithm ..... 10

Adult Modified Brain Injury Guideline (mBIG) 1 ED Patient Observation Pre-Printed Order Set ..... 11

Appendix D - Suggest Patient Discharge Education Handout ..... 13

Abbreviation List ..... 16

Acknowledgements ..... 17

References ..... 18

# Disclaimer

The Ontario Modified Brain Injury Guidelines, accompanying sample order sets, and sample discharge summary templates included in this package (collectively, Ontario mBIG) are evidence-informed and reflect the consensus opinions of the Ontario Health Neurosurgery Clinical Leadership group comprised of healthcare professionals, including emergency medicine and neurosurgical expertise.

The Ontario mBIG is intended to support clinical decision-making in the management of adult patients with traumatic subdural hematoma and traumatic subarachnoid haemorrhage. It is not intended to constitute a standard of care, nor is it a substitute for the independent clinical judgment of qualified healthcare professionals.

The assessment, treatment, and management of adult patients with traumatic brain injury may vary based on individual patient factors, clinical presentation, and provider judgment. As such, healthcare professionals may encounter circumstances where the Ontario mBIG, sample order sets, or discharge summary templates require modification, are not appropriate, or do not apply. Decisions related to patient care and the use or application of the Ontario mBIG are the sole responsibility of the Most Responsible Practitioner/Physician. Ontario Health expressly disclaims any responsibility or liability for damages, loss, injury, or liability resulting from reliance on information within the Ontario mBIG.

# Executive Summary

This document has been collaboratively developed in partnership by Ontario Health's Critical Care Services Ontario, Neurosurgery Program and Ontario Health Emergency Services to support the adaptation and implementation of the Modified Brain Injury Guidelines (mBIG) pathway for the management of adult patients presenting with traumatic subarachnoid haemorrhage (tSAH) and traumatic subdural hematoma (tSDH) in Ontario emergency departments.

The purpose of this document is to provide clinicians with a comprehensive, evidence-informed framework that promotes timely assessment, standardized decision-making, and coordinated care and reflects the consensus of the Ontario Health Neurosurgery Clinical Leadership group and Ontario Health Emergency Services. It is intended to provide evidence-based support in the care of tSAH and tSDH, but not replace clinical judgment.

Ontario Health is pleased to endorse the role of Ontario Health Emergency Department (ED) Peer Physicians in facilitating the Ontario mBIG pathway as an important advancement in the care and management of patients with mild traumatic brain injury. This model represents a meaningful evolution from traditional reliance on neurosurgical consultation alone, enabling timely access to expert guidance within a structured and collaborative framework.

Together, the tools and guidance contained in this package, including the Ontario mBIG, emergency department workflow guidance, and sample admission order sets are intended to support clinicians and organizations in delivering high-quality, consistent, and patient-centred care across Ontario.

# Adult Modified Brain Injury Guideline (mBIG) –Adapted for Use in Ontario

**CritiCall Ontario 1-800-668-4357**

| **mBIG 3 – HIGH RISK** | **Are ANY of the following present?** |
|---|---|
| **Radiographic Findings**<br>• Intraventricular haemorrhage<br>• Epidural hematoma<br>• Intraparenchymal haemorrhage ≥ 8mm or multiple<br>• Traumatic subarachnoid haemorrhage > 3 sulci AND bi-hemispheric AND non-aneurysmal<br>• Displaced skull fracture<br>**Clinical Findings**<br>• Abnormal neuro Exam[A]<br>• Anticoagulation or antiplatelet[B] | **If yes → ACTION**<br>• Call CritiCall Ontario to request consultation with neurosurgery centre<br>**If No → assess for mBIG 2 below**<br>• If worsening neuro exam[A], escalate to mBIG3 pathway |
| **mBIG 2 – medium RISK** | **Are ANY of the following present?** |
| **Radiographic findings**<br>• Traumatic subdural hematoma 4.1-7.9 mm<br>• Intraparenchymal haemorrhage 4.1-7.9 mm<br>• Traumatic subarachnoid haemorrhage >3 sulci AND single hemisphere AND non-aneurysmal<br>• Nondisplaced skull fracture<br>**Clinical Findings**<br>• Intoxication[C] | **If yes → MANAGEMENT (see Appendix mBIG 2 Admission Orders)**<br>• Hospital admission for 24-48 hours<br>• Repeat head CT<br>• No neurosurgery consult required<br>• Neurological assessment every 2 hours<br>• For additional support, call CritiCall Ontario |
| **mBIG 1 – LOW RISK** | ***Confirm Intracranial Haemorrhage Size*** |
| • Traumatic subdural hematoma ≤4mm<br>• Intraparenchymal haemorrhage ≤4mm<br>• Traumatic subarachnoid haemorrhage ≤3 sulci (total) AND non-aneurysmal<br>**Clinical findings**<br>• Absence of high-risk clinical criteria - GCS 15, no intoxication and no use of anticoagulants | **If yes → MANAGEMENT**<br>• Up to 6 hours ED observation (post CT scan) using mBIG 1 ED Observation Algorithm<br>• No repeat head CT required<br>• No neurosurgery consult<br>• For additional support, call CritiCall Ontario |
| **Clinical Considerations** | |
| A. Abnormal neuro exam (ANY of below) In<br>• Glasgow Coma Scale (GCS) < 13<br>• Focal neurologic or pupillary abnormalities<br>• Any decline in GCS from baseline presentation escalates to mBIG 3 pathway<br>B. Anticoagulation / Antiplatelet<br>• Warfarin, Clopidogrel, Enoxaparin<br>• Aspirin > 81 mg / day<br>• Consider lab-confirmed coagulopathy (INR > 1.5 or platelet count < 80 K / mcL)<br>• Direct oral anticoagulants (DOAC)<br>• Low molecular weight Heparin (LMWH)<br>• Heparin<br>• DOES NOT include NSAIDs | C. Intoxication<br>• Blood alcohol levels > 80 mg / dL or >17.4 mmol/L should trigger escalation of care. If patents neurological status is affected by intoxication, it is reasonable to allow intoxication to clear before determining mBIG category.<br>D. Discharge:<br>• A GCS 15 or return to neurologic baseline required for ED or hospital discharge in mBIG 1 – 2 patients<br>E. Observation of mBIG 1 in ED<br>• T=0 is measured at time of CT scan<br>• ED provider oversees 6 hour observation period post CT scan<br>• Observation may be shortened if > 24 hours between injury and presentation<br>• ED BIG-Brain Injury Guidelines Power Plan<br>• Neurologic checks every 2 hours |

# Appendix A – Ontario mBIG 2 Traumatic Subarachnoid Haemorrhage Sample Order Sets

## Adult Modified Brain Injury Guideline (mBIG) 2 Traumatic Subarachnoid Haemorrhage (tSAH)

| | |
|---|---|
| Attending Physician: | MRN: |
| Facility/Referring Provider: | Patient Name: |
| Admission: | DOB: |
| Diagnosis: □ Traumatic Subarachnoid Haemorrhage | Allergies: □ None known |
| | Code Status: □ Full Code □ DNR □ Other |

| Item | Order | |
|---|---|---|
| 1 | **NEUROLOGICAL MONITORING**<br>□ Neuro checks + Glasgow Coma Scale (use institutional neurological assessment protocol where available; otherwise assess using Glasgow Comma Scale and limb motor power)<br>□ q2h × 6 hrs q4h if stable | |
| | **Notify Provider STAT for:**<br>□ ↓ Glasgow Coma Scale<br>□ New focal deficit<br>□ Persistent vomiting | □ Seizure activity<br>□ Worsening headache<br>□ Systolic Blood Pressure outside parameters |
| 2 | **VITAL SIGN TARGETS**<br>□ Systolic Blood Pressure 100–140 mmHg<br>□ $SpO_2$ > 94%<br>□ Maintain normothermia (treat >38°C) | |
| 3 | **IMAGING**<br>□ Repeat CT/CTA in 6–12 hours | □ Repeat CT with neuro change |
| | **If repeat CT shows interval increase in SAH but SAH remains unilateral and no neuro change, repeat plain CT in subsequent 8 hours.**<br>**If CTA shows concern for vascular lesion, consult Neurosurgery.** | |
| 4 | **LABS**<br>□ CBC<br>□ Glucose<br>□ Type & Screen | □ Alcohol/Toxicology (if indicated)<br>□ Electrolytes, BUN, Cr<br>□ INR/PTT<br>□ LFTs |
| 5 | **MEDICATIONS**<br>**Seizure Prophylaxis (only if seizure):**<br>□ Levetiracetam _____<br>**Analgesia:**<br>□ Acetaminophen _____<br>**ASA 81 mg is not contraindicated in tSAH<br>**Avoid NSAIDs | **Opioids (if required):**<br>□ Hydromorphone ____<br>□ Oxycodone ____<br>**Blood Pressure Management:**<br>□ Labetalol ____<br>□ Hydralazine ____ |
| 6 | **VENOUS THROMBOEMBOLISM PROPHYLAXIS**<br>□ Sequential Compression Devices (SCDs) | □ Start Low-Molecular Weight Heparin ONLY after no change on repeat CT |
| 7 | **FLUIDS & DIET**<br>**IV Fluids**:<br>□ 0.9% Normal Saline _____<br>□ Avoid hypotonic fluids | **Diet:**<br>□ NPO<br>□ Clear Fluids<br>□ Full Diet if stable |
| 8 | **ACTIVITY & POSITIONING**<br>□ Head of Bed at 30° | □ Mobilize when stable<br>□ Fall precautions |
| 9 | **CONSULTS**<br>□ PT/OT | □ Social Work |
| 10 | **DISPOSITION**<br>**Discharge when:**<br>□ Stable neuro exam<br>□ Pain controlled | □ Stable repeat CT<br>□ No outpatient neurosurgery consult required (expert opinion) |

Physician Signature: _____ Date/Time:_____

# Appendix B – Ontario mBIG 2 Traumatic Subdural Hematoma (tSDH) Sample Order Sets

## Adult Modified Brain Injury Guideline (mBIG) 2 Traumatic Subdural Hematoma (tSDH) Management

| | | |
|---|---|---|
| Attending Physician: | | MRN: |
| Facility/Referring Provider: | | Patient Name |
| Admission: | | DOB: |
| Diagnosis: □ Acute subdural hematoma □ Chronic subdural hematoma □ Mixed density subdural hematoma | | Allergies: □ None Known |
| Location: □ Left □ Right □ Bilateral | | Code Status: □ Full Code □ DNR □ Other |
| **Item** | **Order** | |
| 1 | **NEUROLOGICAL MONITORING**<br>□ Neuro checks + Glasgow Coma Scale (use institutional neurological assessment protocol where available; otherwise assess using Glasgow Coma Scale and limb motor power)<br>□ q2h × 6 hrs → q4h if stable | |
| | **Notify Provider STAT for:**<br>□ ↓ Glasgow Coma Scale<br>□ New focal deficit<br>□ Persistent vomiting | □ Seizure activity<br>□ Worsening headache<br>□ Systolic Blood Pressure outside parameters |
| 2 | **VITAL SIGN TARGETS**<br>□ Systolic Blood Pressure 100–140 mmHg<br>□ $SpO_2$ > 94%<br>□ Maintain normothermia (treat >38°C) | |
| 3 | **IMAGING**<br>□ Repeat CT at 6-12 hrs (acute subdural hematoma)<br>□ Repeat CT with neuro change<br>**If repeat CT shows interval increase and tSDH remains <8 mm with no neuro change, repeat scan in subsequent 8 hours. | |
| 4 | **LABS**<br>□ CBC<br>□ Glucose<br>□ Type & Screen<br>□ Alcohol/Toxicology (if indicated) | □ Electrolytes, BUN, Cr<br>□ INR/PTT<br>□ LFTs |
| 5 | **MEDICATIONS**<br>**Seizure Prophylaxis (only if seizure):**<br>□ Levetiracetam _____<br>**Analgesia:**<br>□ Acetaminophen _____<br>□ HOLD Aspirin for 7-10 days<br>**Avoid NSAIDs | **Opioids (if required):**<br>□ Hydromorphone _____<br>□ Oxycodone _____<br>**Blood Pressure Management:**<br>□ Labetalol _____<br>□ Hydralazine _____ |
| 6 | **VENOUS THROMBOEMBOLISM PROPHYLAXIS**<br>□ Sequential Compression Devices (SCDs) | □ Start Low-Molecular Weight Heparin ONLY after no change on repeat CT |
| 7 | **FLUIDS & DIET**<br>**IV Fluids**:<br>□ 0.9% Normal Saline _____<br>□ Avoid hypotonic fluids | **Diet:**<br>□ NPO<br>□ Clear Fluids<br>□ Full Diet if stable |
| 8 | **ACTIVITY & POSITIONING**<br>□ Head of Bed at 30° | □ Mobilize when stable<br>□ Fall precautions |
| 9 | **CONSULTS**<br>□ PT/OT<br>□ Social Work | |
| 10 | **DISPOSITION**<br>**Discharge when:**<br>□ Stable neuro exam<br>□ Pain controlled | □ Stable repeat CT<br>□ No outpatient neurosurgery consult required (expert opinion) |

Physician Signature: _____ Date/Time: _____

# Appendix C – Adult mBIG 1 ED Observation

## Adult Modified Brain Injury Guideline (mBIG) 1 ED Patient Observation Pre-Printed Order Set

| | |
|---|---|
| Attending Physician: | MRN: |
| Facility/Referring Provider: | Patient Name: |
| Diagnosis: □ mBIG 1 Intracranial Haemorrhage | DOB: |
| Code Status: □ Full Code □ DNR □ Other | Allergies: □ None Known |

| Item | Order | |
|---|---|---|
| 1 | **ED OBSERVATION**<br>□ Hold in Emergency Department for observation | |
| 2 | **NEUROLOGICAL MONITORING**<br>□ Neuro checks + Glasgow Coma Scale (GCS) q2h × 6 hrs<br>**Notify Provider STAT for:**<br>□ ↓ Glasgow Coma Scale<br>□ New focal deficit<br>□ Persistent vomiting<br>□ Seizure activity<br>□ Worsening headache<br>□ Systolic Blood Pressure outside parameters | |
| 3 | **VITAL SIGN TARGETS**<br>□ Systolic Blood Pressure 100–140 mmHg<br>□ $SpO_2$ > 94%<br>□ Maintain normothermia (treat >38°C) | **IMAGING**<br>□ No repeat imaging required unless clinical deterioration |
| 4 | **LABS**<br>□ CBC<br>□ Electrolytes, BUN, Cr<br>□ Glucose<br>□ INR/PTT | □ Type & Screen<br>□ LFTs<br>□ Alcohol/Toxicology (if indicated) |
| 5 | **MEDICATIONS**<br>**Analgesia:**<br>□ Acetaminophen _____<br>□ If patient has traumatic subdural hematoma **and** is on ASA 81 mg, **hold for 7 days**<br>**Avoid NSAIDs | **Opioids (if required):**<br>□ Hydromorphone _____<br>□ Oxycodone _____<br>**Blood Pressure Management:**<br>□ Labetalol _____<br>□ Hydralazine _____ |
| 6 | **FLUIDS & DIET**<br>**IV Fluids:**<br>□ 0.9% Normal Saline _____<br>□ Avoid hypotonic fluids | **DIET**<br>□ NPO<br>□ Clear Fluids<br>□ Full Diet if stable |
| 7 | **ACTIVITY & POSITIONING**<br>□ Head of Bed at 30°<br>□ Mobilize when stable<br>□ Fall precautions | **CONSULTS**<br>□ PT/OT<br>□ Social Work<br>□ Geriatric Evaluation and Management<br>□ Ontario Health at Home |
| 8 | **DISPOSITION**<br>**Discharge when:**<br>□ GCS 15 or at neurological baseline<br>□ Stable neuro exam at 6 hours<br>□ Pain controlled<br>□ Provide and review mBIG 1 discharge education handout to patient/caregiver | |

Physician Signature: _____ Date/Time: _____

# mBIG 1: Suggested ED Scripting

Clinicians may use the following scripting when using the Ontario brain injury guideline for low-risk patients. It may be used to support clinician-clinician and/or clinician-patient communication in alignment with the new guidelines.

After careful review, this patient's clinical status and their CT findings meet the criteria outlined in mBIG 1.

This patient has been diagnosed with a low-risk brain injury using the Ontario Brain Injury Guideline. The management algorithm has been followed.

Neurosurgery consultation is not required at this time.

This patient should be observed in the ED for 6 hours with q2 hour neurological assessment. If/when the patient's serial neurological assessments remain normal, their GCS is 15 or at neurological baseline, the patient may be discharged home.,

No hospital admission is necessary unless there are other clinical or social concerns that require admission.

This patient does not require a repeat head CT.

If at any time there are new clinical concerns or the patient experiences any clinical deterioration, the patient will be reassessed.

At discharge, the patient will be provided written discharge instructions for home management of their minor brain injury and reasons to return to the ED. These instructions will ensure communication to the patient and their care-givers as well as other members of their health-care team. The patient's disposition will consider their clinical condition, co-morbidities and social supports.

# Appendix D - Suggest Patient Discharge Education Handout

# Appendix D

## Patient Discharge Education Handout

**Discharge Summary: Low Risk Head Injury**
You were evaluated today for a mild head injury. Based on your symptoms, examination, and brain imaging, your injury is classified as low risk based on the modified Brain Injury Guidelines (mBIG).
Your head injury does not require specialist or neurosurgical intervention at this time.
Your condition is stable, and it is safe for you to be discharged home with careful monitoring.

**What to expect**
It is common to have some mild symptoms after a head injury (also known as a "concussion"), including:

- Headache
- Mild nausea
- Fatigue
- Dizziness
- Sensitivity to light or noise
- Trouble concentrating
- Mild soreness

These symptoms often improve gradually over days to weeks.

**Care at home**

- Rest and avoid heavy exertion for the next 24-48 hours.
- Gradually return to normal activity as tolerated.
- Avoid alcohol, recreational drugs, and sedating medications unless prescribed until symptoms are resolved.
- Use acetaminophen for headache unless told otherwise by your clinician.
- Do not drive, operate heavy machinery, or make important decisions if you feel dizzy, confused, or drowsy.
- Have a responsible adult stay with you or check on you for the first 24 hours if possible.

**Return to the Emergency Department immediately if you have:**

- Worsening headache
- Repeated vomiting
- Increasing drowsiness or difficulty waking up
- Confusion, unusual behavior, or worsening memory problems
- Weakness, numbness, or trouble walking
- Slurred speech
- Seizure
- Vision changes
- Loss of consciousness
- Any new or worsening neurologic symptoms

**Follow-up**

Follow up with your primary care provider or the recommended clinic (i.e., concussion clinic, sport medicine clinic etc.) as directed. Patients without a primary care provider should call Health811 (dial 811) for clinical guidance and follow-up support. If your symptoms are not improving, or if you have concerns about returning to work, school, or sports, seek reassessment.

**Activity restrictions**

Do not return to sports, high-risk activity, or activities with risk of another head injury until cleared by your primary care provider.

# Abbreviation List

| Abbreviation | Definition |
|---|---|
| ASA | Aspirin (acetylsalicylic acid) |
| BUN | Blood Urea Nitrogen |
| CBC | Complete Blood Count |
| Cr | Creatinine |
| CT | Computed tomography |
| CTA | Computed Tomography Angiography |
| DNR | Do Not Resuscitate |
| DOB | Date of Birth |
| DOACs | Direct Oral Anticoagulants |
| DVT | Deep Vein Thrombosis |
| ED | Emergency Department |
| EDH | Epidural hematoma |
| EtOH | Ethanol (alcohol) |
| GCS | Glasgow Coma Scale |
| GEM | Geriatric Evaluation and Management |
| HOB | Head of Bed |
| INR | International Normalised Ratio |
| IPH | Intraparenchymal haemorrhage |
| IV | Intravenous |
| IVH | Intraventricular haemorrhage |
| LFTs | Liver Function Tests |
| LMWH | Low Molecular Weight Heparin |
| mBIG | Modified Brain Injury Guidelines |
| MRN | Medical Record Number |
| NPO | Nil per os (nothing by mouth) |
| NS | Normal Saline |
| NSAIDS | Nonsteroidal Anti-Inflammatory Drugs |
| PO | By mouth (per os) |
| PRN | As needed (pro re nata) |
| PT/OT | Physical Therapy / Occupational Therapy |
| PTT | Partial Thromboplastin Time |
| SAH | Subarachnoid haemorrhage |
| SBP | Systolic Blood Pressure |
| SCDs | Sequential Compression Devices |
| $SpO_2$ | Peripheral oxygen saturation |
| tSAH | Traumatic Subarachnoid Haemorrhage |
| tSDH | Traumatic Subdural Hematoma |
| VTE | Venous Thromboembolism |

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