**FAST FACTS AND CONCEPTS #239**
**PROGNOSTICATION IN SEVERE TRAUMATIC BRAIN INJURY IN ADULTS**

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**Background**      Traumatic brain injury (TBI) is defined as brain injury caused by an external force – most commonly falls, struck by/against events, motor vehicle collisions, and assaults.  The vast majority of patients with mild to moderate TBIs have substantial recoveries; this is not true of severe TBIs.  This *Fast Fact* discusses prognostication in severe TBI in adults.

**Initial TBI severity**      TBI severity is most commonly graded by the initial Glasgow Coma Scale (GCS) score.  The GCS rates the patient's best verbal response, best motor response and the stimulus needed to elicit eye opening.  Scores range from 3-15, with score ≤ 8 representing coma.  'Mild' TBI (accounting for ~80% of cases) is manifest by a 30 minute post-injury GCS of 13-15.  'Moderate' TBI consists of immediately altered or loss of consciousness for > 30 minutes and 6 hour post-injury GCS of 9-12. 'Severe TBI' involves immediate loss of consciousness for > 6 hours with residual GCS of 3-8.

**Long-term outcomes**      The Glasgow Outcome Scale (GOS) is a five-point scale used widely in brain injury research.  An eight-point Extended Glasgow Outcome Scale (GOS-E) is available with more sensitivity to change in function, but most outcome studies reference the GOS.  The GOS range is (1) death, (2) persistent vegetative state (unconscious and unable to interact), (3) severe disability (conscious; cannot live independently; requires daily assistance due to physical or mental impairment), (4) moderate disability (able to live independently; able to work in a supported environment), and (5) good recovery (minimal or no deficits; able to work and socialize normally).  In addition to global functional impairments, survivors of severe TBIs often have impairments in memory, executive functioning, impulse control, sensory processing, and communication skills.  Mental health problems are common.

**Predicting outcomes**      Overall 30-day mortality following TBI is estimated to be 20% with the highest mortality corresponding to the worst initial GCS scores. For patients with reliable initial GCS scores of 3-5, only 20% will survive and less half of those survivors will have what is often referred to in the research literature as a 'good outcome' (GOS 4-5).  Older age, lower initial GCS score, abnormal initial pupil reactivity, longer length of coma and duration of post-traumatic amnesia, and certain computed tomography findings all indicate a smaller chance of recovery to GOS 4-5.  Kothrari proposed the following prognostic guidelines, based on a comprehensive review of studies that looked at outcome in adults 6 months or later after severe TBI [8]:
- Favorable outcome (GOS 4-5) likely when the time to follow commands is less than 2 weeks after injury, and the duration of post-traumatic amnesia is less than 2 months.
- Poor outcome (GOS <4) is likely when the patient is > 65 years old, the time to follow commands is longer than 1 month, or the duration of post-traumatic amnesia is greater than 3 months.
- Notably, 10% of patients will not have the outcome predicted by the guidelines above.

A multinational collaborative trial developed a prognostic model (referred to as the CRASH prognostic mode) which has been validated to predict outcomes in TBI (9,10).  The model is available online and uses age, GCS, pupil reactivity, presence of major extracranial injury, and (optional) computed tomography findings to give rates of death at 14 days post-injury and GOS at 6 months for survivors (11).

**Helping families make decisions**      Families of patients with severe TBIs may be confronted with decisions about medical care (e.g. gastrostomy tube placement, chronic ventilatory support, dialysis). Such decisions often depend on a family's understanding of a patient's long-term functional outcome. The above-mentioned prognostic indicators can help clinicians provide objective information for families about the likelihood of recovery after a TBI.  As with all prognostic tools, however, clinicians can only predict what would happen to a population of patients with a similar injury (e.g. 'only 10% of patients would recover such that they could live independently'); this is different from predicting any particular patient's course.  It is important to communicate the uncertainty that accompanies most prognostic estimations.  Counseling families about long-term functional prognosis, as well as the expected treatment course (what rehabilitation would involve) is important.  While the research literature often defines a 'good recovery' as GOS 4-5, that may not constitute a 'good' recovery for an individual patient.  Clinicians

should avoid such language at the bedside and instead use detailed descriptive language of expected functional and cognitive outcomes. Early and frequent family meetings can facilitate communication, built rapport, and are vital in expectation setting and establishing goals of care.  If life sustaining treatments are initiated, framing the treatments in the context of time-limited trials is helpful.  This empowers family members to discontinue certain cares after a specified period of time if the prognosis remains unchanged or if the treatment is not meeting the goals of care (e.g. helping to restore a patient to a functional status which is acceptable to the patient).  Interdisciplinary team members including speech, occupational, and physical therapists, physiatrists, neurologists, palliative care clinicians, and neurosurgeons can be important in letting family members more fully understand a patient's likely future.  See *Fast Fact* #226 about helping surrogates make decisions.

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