Optimal Oxygen Saturation for Traumatic Brain Injury: A Review

Context
Traumatic brain injury (TBI) is the leading cause of death and disability in young adults in the developed world. The estimated incidence of severe traumatic brain injury is 11.4 people for every 100,000 Canadians. The incidence of mild TBI is even higher, at an estimated 600 out of every 100,000 Canadians. The number of people living with traumatic brain injury in Canada is unknown. Injury to the brain progresses over hours or days, and secondary injuries such as edema, hematoma, increased pressure in the brain, infection, or seizures may occur.

Technology
One of the primary goals of prehospital management of TBI is to prevent a lack of oxygen or hypoxia (PaO₂ < 60 mm Hg; O₂ saturation < 90%), a major cause of secondary injury after TBI. Hypoxia can be reversed by aggressive airway management to increase oxygen tension. While the association between hypoxia and poor outcomes from TBI has been well-documented, less is known about the impact of other oxygen levels on patient outcomes.

Issue
Patients with severe head injury often have other traumatic injuries, making the management of TBI a complex process — and the prevention of hypoxia difficult. A review of the clinical evidence on optimal oxygen levels in TBI, as well as a review of the guidelines, will help to guide decisions about the management of TBI.

Methods
A limited literature search was conducted of key resources, and titles and abstracts of the retrieved publications were reviewed. Full-text publications were evaluated for final article selection according to predetermined selection criteria (population, intervention, comparator, outcomes, and study designs).

Key Messages
For the management of traumatic brain injury:
- Higher than normal oxygen levels — hypoxia — seem to decrease the chances of surviving in hospital compared with normal oxygen levels.
- The maximum safe oxygen saturation level is uncertain.
- Oxygen levels of less than 90% are not recommended in patients with severe TBI according to one guideline document.

Results
The literature search identified 170 citations of which 5 were deemed potentially relevant. An additional 3 reports were found from the grey literature search. Of these 8 studies, 3 met the criteria for inclusion in this review: 2 retrospective observational studies and 1 evidence-based guideline.