

# PHARMACOLOGY AND THE INJURED BRAIN: Intended Benefits and Potential Harms

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## THE INJURED BRAIN

The brain is the most complex system in the Universe.



If you've seen one brain injury,  
You've seen one brain injury.

- Of all neuropsychiatric disorders, traumatic brain injury is most heterogeneous.
- There is not one FDA approved medication for treatment of brain injury.
- The injured brain is sensitive to medication effects and side effects.

## NEUROTRANSMITTER IMPAIRMENT IN TBI

### NEUROBEHAVIOURAL PROBLEM

NEUROBEHAVIOURAL PROBLEM	NEUROTRANSMITTER IMPAIRMENT
Amotivation/Apathy	Dopamine (DA), Norepinephrine (NE)
Short-term Memory	Acetylcholine (ACH)
Working Memory	DA, NE, ACH
Processing Speed	Catecholamines (CAT), ACH
Disinhibition	Interaction of GABA, CAT, Serotonin (Se)
Attention	DA, NE, ACH
Depression	DA, NE, Se

## ANTICHOLINERGIC EFFECT

### SIDE EFFECTS

- Memory impairment
- Sedation
- Confusion
- Drowsiness
- Delirium
- Hallucinations
- Dry mouth
- Difficulty urinating
- Constipation
- Blurred vision
- Decreased sweating
- Decreased saliva

### SIGNS OF OVERDOSE

- Dizziness
- Severe drowsiness
- Fever
- Severe hallucinations
- Confusion
- Trouble breathing
- Clumsiness and slurred speech
- Fast heartbeat
- Flushing and warmth of the skin

**Anticholinergic effects of medications are additive.**

## COMMONLY USED MEDICATIONS WITH ANTICHOLINERGIC EFFECTS

MEDICATION	USES	EFFECT
Amitriptyline	Headaches, pain, sleep	High
Furosemide	Diuretic, BP control, swelling	High
Oxybutinin	incontinence, bladder spasm	High
Scopolamine	Dizziness, nausea, GI cramping	High
Cyclizine	Dizziness, nausea, vomiting	High
Quetiapine	Delirium, agitation, sleep	High/mod
Tramadol	Pain	Mod
Baclofen	Spasticity, tone, spasms	Mod
Carbamazapine	Seizure, agitation, aggression	Mod

## BASIC TENETS OF NEUROPHARMACOLOGY

- Target your treatment to the hypothesized causation (neuropathobiology, metabolic, pain), not the behaviour.
- Assess and weigh all contributing factors including environment and external inputs. Watch and listen to staff and family.
- Use medication as an adjunct to other treatments.
- Regularly reevaluate the intervention and efficacy.
- Make sure you are not treating another medication side effect.
- Start low and go slow. Low dose polypharmacy can be good.
- Experienced clinicians make mistakes in this process. It is OK to be wrong. It is not ok to be sloppy in your thinking.<sup>3</sup>

## THE RISK OF ANTICHOLINERGICS IN TBI?

- 'Strongest Evidence Yet' Links Anticholinergic Drugs to Dementia
- Just 2 Months' Exposure to Anticholinergics Affects Cognition
- Pain Patients at Cognitive Risk From Anticholinergic Burden?
- A younger population may manifest CNS events..cognitive changes, dizziness, somnulence, sedation.
- M1- cognitive impairment, memory loss. (M2 – increase heart rate, prolonged QT, M3 – constipation, blurred vision, dry mouth).

**The anticholinergic burden of multiple medications has been shown to be additive.**

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