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Fast-acting, readily available gas may mitigate blast-induced brain injury

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Credit: Imperial College London

The inert gas has been used for the first time to try and reduce the impact of traumatic brain injuries (TBI) caused by blasts such as those in conflict zones and terror attacks.

Traumatic brain injuries are frequently caused by blunt force trauma, but there has been an increase in TBIs caused by blasts (bTBIs). Blast TBI is one on the most common injuries experienced by soldiers in recent conflicts, and is dubbed a 'signature injury' of the conflicts in Iraq and Afghanistan. Civilians exposed to industrial accidents or terrorist attacks are also at risk.

Unlike blunt force trauma, where damage/injury is usually localised to one area of the brain, blasts create a shockwave that affects the whole brain - causing widespread damage. This can cause anxiety, depression, and problems with cognition, memory and sleep.

Previously, Dr Robert Dickinson and colleagues from Imperial College London showed that xenon gas helped limit brain damage and improve long term neurological outcomes in mice which had suffered blunt force brain injury.

Now, the same research group has found for the first time that xenon can also limit blast-induced brain injury from developing in mouse brain tissue exposed to a blast shockwave, in a study published in the *Journal of Neurotrauma*.

In this study, the researchers from Imperial's Department of Surgery and Cancer and the Royal British Legion Centre for Blast Injury Studies, applied xenon to slices of mouse brain tissue after exposing them to blast shockwaves that emulated those produced by improvised explosive devices (IEDs).

By using a dye that highlights damaged brain cells, they were able to monitor injury development in the slices up to three days after blast exposure. They compared slices given xenon treatment starting one hour after exposure to blast shockwaves, with slices exposed to blast without xenon treatment.

They then assessed injury development at 24, 48 and 72 hours after blast exposure, and found that the slices treated with xenon suffered significantly less blast-induced injury than the untreated control slices. The blast-injured slices treated with xenon were not significantly different to uninjured slices at 24 hours and 72 hours after injury, indicating that xenon prevented injury from developing.

Xenon reaches the brain within a few minutes after inhalation, so if these preliminary results translate to humans it could be a viable treatment option after blasts occur. Lead author Dr Rita Campos-Pires from Imperial said: "One of the most insidious aspects of TBI in general, and it is believed bTBI also, is that the damage can continue to grow long after the initial injury. The secondary injury can be many times worse than the primary injury, so our goal is to stop the damage from spreading as early as possible."

Xenon is used in hospitals as a general anaesthetic, so it is already known to be safe in humans. The authors say more research is needed before clinical trials in bTBI patients, but that their results are a positive step in this direction.

Dr Dickinson said: "Blast TBI has not been as widely studied as other types of brain trauma, but is now becoming recognised as a specific injury that can result in debilitating symptoms. Our discovery that xenon reduces blast-induced injury in mouse brain tissue is very encouraging, and will prompt further research in this area."

There is currently no standard treatment for bTBI. The authors say this preliminary research may be a first step before exploring xenon's benefits in humans who suffer bTBI. The next stage will be to test xenon in live rodents exposed to similar conditions.

More information: Rita Campos-Pires et al, Xenon Protects against

Blast-Induced Traumatic Brain Injury in an In Vitro Model, *Journal of Neurotrauma* (2017). DOI: 10.1089/neu.2017.5360