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News

Cellular 'puncture repair kit' may minimize brain trauma

Chemical compound could be key asset for hospital emergency units.

Lucas Laursen

The treatment could help trauma victims avoid the severest injuries.

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Researchers have devised a treatment that mechanically repairs burst cell membranes in the brain, somewhat like puncture sealants used in bicycle tyres, and could therefore help to avert brain damage after serious head injuries.

Brain-injured rats that are injected with a polymer called polyethylene glycol (PEG) soon after their injuries recover certain behavioural abilities better than untreated rats, report researchers in this week's *Journal of Biological Engineering* [1].

PEG, a commonly available substance already used medically for stomach pumping, has reached clinical testing with naturally injured dogs, a step towards human testing. It is one of several polymers and sugars that show potential for reducing the impact of blunt traumas to the brain, according to author Richard Borgens of Purdue University in West Lafayette, Indiana.

The therapy "does not require sophisticated technology", says Borgens, "it requires sophisticated thinking". He says it acts by absorbing water, promoting the healing of cell membranes and preventing "the exchange of things that cause decay and degeneration of the cell". Once it reaches human trials, PEG could be carried by trauma units and administered as soon as emergency crews reach victims of blunt-force trauma.

A bump on the head

To get uniform results, the authors administered a standard injury known to damage certain regions of the brain by dropping a weight onto 47 rats. The researchers then injected a solution of PEG into the rats' bloodstreams 2 hours, 4 hours or 6 hours after the injury.

They left one group of rats untreated, and one group uninjured — these rats went through a mock-up of the experiment, including a placebo injection — to provide a baseline for the behavioural assessments.

The researchers then released the rats into an activity chamber to measure their activity levels one day after injury, 3 days later, and a week after injury. The cage was equipped with infrared sensors to measure how far the rats travelled, where they moved to, and how fast.

The PEG treatment was found to improve behavioural results for the rats treated within 4 hours of injury. Those treated after a six-hour delay did not recover any more behavioural performance than the untreated rats.

Clinical applications

The behavioural test was innovative, says David Brody of Washington University School of Medicine in St. Louis, Missouri, because previous studies with PEG and a related compound called poloxamer-188 have generally measured only their effect on tissues. "These therapeutics could have side effects that would render the behavioural abnormalities worse, even if the histological abnormalities were improved," says Brody, "so it is very important that behavioural assessments are performed".

But Borgens warns that it is still too early to know whether humans will show similar results. For instance, although benefits are seen in rats treated up to 4 hours after injury, he says "we don't know what that will translate to when this moves to human clinical testing".

Brody would also like to see a future study that follows up on the therapy's effects over a longer time period. Brain trauma "recovery is a long process, typically 6 to 12 months in humans", he says, adding that "there's been a long history in the field of traumatic brain injury research of things that looked very good in animal models that didn't turn out well in humans".

The treatment is set for clinical testing within two years by an industrial licensee, says Borgens, but he is insistent that this work is gradual and is not a cure for victims of brain injuries. "The idea that one treatment is going to give them an enormous change in quality of life or actually cure them is foolishness. We shouldn't talk about that. What we should talk about is how we can improve their quality of life."

References

1. Koob, A. O. , Colby, J. M. & Borgens, R. B. *J. Biol. Eng.* doi:10.1186/1754-1611-2-9 (2008).