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Treatment of Traumatic Brain Injury: Nanotherapeutics

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Editorial

Nanotechnology and regenerative nanotherapeutics enrich the renewing features and function of the diseased cells and tissue by replenishing the local environment, while inhibiting further degeneration. These featured therapeutics perform cell maintenance and promote cellular events to develop better communication between re-forming molecules of remedies and the brain [1]. These therapeutics treat traumatic brain injury and initiate repair as well as can easily target neurological diseases, despite, it is a difficult task, because of the complex nature of nerve cells, including the difficulty of bypassing the blood brain barriers. Approximately 2.5 million people in the US are suffering from the traumatic brain injuries reported by Sharma et al. [2]. The same research paper claimed that there is a significant reduction in brain swelling and damage in traumatic brain injury after injecting nanoparticles. The paper specifically revealed that these nanoparticles as "500 nm-diameter particles" consist of biopolymer carboxylated poly (lactic-co glycolic) acid can do it within two hours of the injury [3]. Recently, the impact of polymeric nanoparticles and related features, including chemistry, and size, ability of interactions with the vasculature and cells of the brain after injury was detected during the treatment of traumatic brain injury. Nonetheless, the improvement of the behavioral and enhanced neuroprotection is also observed as promises of therapeutic outcomes [4]. Catalytic carbon nano-antioxidant, poly(ethylene)glycol conjugated hydrophilic carbon clusters rapidly restored cerebral perfusion, brain oxidative balance and enhanced functional and structural improvement experimentally in traumatic brain injury complicated by hypotension and resuscitation [5]. One of the main complexities of these strategies treating traumatic brain injury by applying nanotherapeutics is the restrained paths for drug delivery, because of the blood-brain barrier. These persistent obstacles in the brain pathologies can be easily removed by developing new strategies. The penetration ability of nanomedicine in the case of altered cellular up-take, because of change the pathophysiology of the damaged or diseased tissue also affected. Besides it, the immunological and toxicological aspects are other concerns in treating damages and diseases existed beyond the blood brain barrier, here the reported findings about the implementation of the nano-based neuropharmacology and the role of extracellular matrix were illustrated [6]. Neuron-targeted nanoparticles that have in-built abilities for siRNA delivery can treat traumatic brain injuries [7]. Caffeine, notified as a neuroprotective agent during clinical trials conducted for treating neurodegenerative diseases. After applying the nanocoffee particles, a huge change was observed in behavior, protein, and dendritic cells during the treatment of traumatic brain injury [8]. In these trials, improved behavioral outcomes and enhanced neuronal health were noticed. Furthermore, alteration like favorable molecular signaling changes, and dendritic changes also testified to check the validity of the test.

Another concern of brain injuries is neuroinflammation and toxicity. Interestingly, core-cross-linked nanoparticles were tested in a mouse model and obtained results showed that these remedies are reducing neuroinflammation and enhanced the result of traumatic brain injury [9]. A peptide for targeted, and systemic delivery was applied as therapeutic compounds into acute brain injuries and proved effective in targeting delivery [10]. Traumatic brain injury enhanced central and peripheral inflammatory responses [11]. Unfortunately, there is no existing remedy that can effectively and quickly heal the brain-inflamed regions and can be considered as a novel therapeutic towards the effective brain trauma treatments. Recently, biomimetic nanoparticles were reported that can be used as a theranostic tool in treating traumatic brain injury [12]. Moreover, magnetic micelles (chitosan and polyethylene mine (PEI)-coated magnetic micelles) were used to deliver a reporter DNA to the rat brain after mild traumatic brain injury [13]. Nanomedicines designed for

brain delivery/action have a difficult hurdle to overcome, and in this context, some research groups have developed macromolecular therapeutics for treating central nervous system lymphoma and traumatic brain injury. Other research groups have developed nanoparticles to reboot that will treat brain-injury, even those with mild injuries, including stroke. Traumatic brain injury initiates chronic neurodegeneration and initiate Alzheimer disease that specifically inhibits the pathophysiology underlying traumatic brain injury-associated neurodegeneration by targeting tau in traumatic brain injury [14]. The pathological conditions existed during necrosis, because of ischemic diseases and traumatic brain injury can be targeted by applying nanoparticles for detecting traumatic brain injury [15]. Highly loaded nanoparticulate formulation of progesterone is a promising therapeutic for treating traumatic brain injury in emergency_[16]._Nanotechnology presents strategies that can overcome biological barriers and different nanoparticles were considered for analyzing the disease-mediated changes in the brain microenvironment. Later on, these small remedies were applied for nanoscale drug delivery drugs for enhanced cell interaction. These remedies can enhance the nanoparticle-microglial interaction in the ischemic brain for a better treatment [17].

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The authors declare no conflict of interest, financial or otherwise.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability Statement

Due to the nature of the research, [ethical, legal/commercial] supporting data is not applicable and thus not available.

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