Future in neuromedicine: Nanotechnology

Sir,

The concept of nanomedicine is a new and exciting topic. Its application in neurology is a promising field for research. Use of nanoparticles in neuromedicine undoubtedly will open up a new horizon. The aim of this letter is to highlight some recent data about the use of nanotechnology in neuromedicine.

Recently, an animal study has shown an encouraging result in multiple sclerosis as well as autoimmune encephalitis by administration of nanodroplet formulation of pomegranate seed oil.^[1]

In the case of refractory epilepsy, optimum drug delivery to the brain is an ongoing battle. Tryptophan-derived nanoparticles showed promising outcome in drug delivery in refractory seizure disorder patients.^[2] Nanoparticles are postulated to target myeloid cells in epileptogenic brain tissue of rats. Presurgical and intrasurgical localization of epileptic foci can be done by these particles. This technique will be helpful for future treatment of epilepsy.^[3]

Multimer detection system causes differentiation of prion multimers through their multimeric expression of epitopes. Probably, it is going to be a great achievement to diagnose prion-associated diseases using nanotechnology.^[4]

New nanoparticles have been found that can enable remote-controlled magnetic guiding for stem cell homing. The method may result in positive end point for treatment of many diseases including stroke.^[5]

The existence of the blood-brain barrier causes hindrance for targeted drug delivery within brain tissue. "Autocatalytic" approach has been proposed to combat this problem. Few nanoparticles enter into the brain through the process of transcytosis or the gaps in blood brain barrier. The nanoparticles release some blood brain barrier modulators, which results in more nanoparticles entry. This technique has a potential role in treatment as well as imaging of brain tumor.^[6]

Recently, nanoparticles help increase the permeability of blood brain barrier by proper delivery of lexiscan to central nervous system. The technique autocatalytically augments the targeting delivery of chlorotoxin-anchored nanoparticles. Nogo-66 receptor antagonist peptide NEP1-40 loaded nanoparticles have been shown to cause reduction of infarct volume.^[7]

Hence, these nanotechnologies will reduce the problem of drug delivery due to the blood-brain barrier. In the case of neurodegenerative disorders also improved drug delivery will bring a significant improvement in the disease course.^[8]

Gadolinium-based nanoparticles in combination with radiation therapy showed increased tumor cells death in animals with multiple brain melanoma metastasis.^[9]

It is interesting that nanotechnology is emerging as a promising modality for the treatment of brain cancer.

Iron nanoparticles are used for labeling human neural stem cells. This technique will help track the localization as well as the survival of the stem cells. In patients with Parkinson's disease, magnetic resonance imaging (MRI) will detect these labeled stem cells, and it will be helpful for follow-up of the patient.^[10]

Another interesting use of iron nanoparticles is to deliver anti interleukin-1 β to the epileptogenic focus in the temporal lobe. This technique will be helpful for MRI diagnosis and therapy of epilepsy.^[11]

Carbon nanowires and nanotubes are being tried to use in neural repair and regeneration. They have an influence on cellular signal transmission. They are showing promising results in:

1. Neural regeneration and repair
2. Repair of stroke damage
3. Treatment of cancer and brain tumors
4. Improvement of cerebrovascular dysfunction after brain trauma
5. For diagnosis as well as treatment of primary brain tumors
6. Augmentation of neural cell function within the brain.^[12]

Naturally, it is evident that application of nanotechnology will be a great achievement in the field of neurology. It will help diagnose as well as treat many neurologic conditions. We will wait to enlighten ourselves with further knowledge about this in future.

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Conflicts of interest

There are no conflicts of interest.

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