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Chitosan-based biomaterials for closure of dural defects

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Closure of dural defects is a necessity after neurosurgical procedures to prevent cerebrospinal fluid leakage and to reduce the risk of perioperative infections. Reconstruction of the dura matter with endogenous material becomes very common. However, harvesting of periosteum or fascia lata may require extended surgical approach, additional incisions and time intensive suturing. A wide range of biomaterials, both of natural and synthetic origin, are being investigated for potential applications in dural defect repair.

Biocompatibility, nontoxicity and lack of antigenic activity represent the key determining criteria to create new biomaterials. Antibacterial properties and ability to stimulate regenerative processes are the desirable properties of new biomaterials. Chitosan is one of the high-promising bases for it.

Thus, the aim of our research is to create a biocompatible and nontoxic chitosan-based material to repair dural defects. Besides, we evaluate its biological properties.

The artificial membrane was prepared in 3 % chitosan solution (molecular weight – 200 kDa, degree of deacetylation – 80 – 90 %) with addition of chitin in ration 50:50. The film was made of it; then the film was treated with 5 % NaOH and glycerin solution to improve elasticity. We examined membranes for certain characteristics: tensile strength, rate of biodegradation and biocompatibility.

Our results appeared to confirm high strength properties that were slightly different from those of the native dura. Regarding to the rate of biodegradation this material can be applied as a permanent material to repair dural defects.