Chicken chorioallantoic membrane model

Experimental vasospasm models are irreplaceable for the evaluation of new antivasospastic drugs. Döring et al. from Göttingen assessed the reliability of in vivo vasospasm induction by ultrasound application in the chicken chorioallantoic membrane model (CAM). After incubation of fertilized chicken eggs for four days, a fenestration was performed to enable examination of the CAM vessels. On the thirteenth day, continuous-wave ultrasound (3 MHz, 1 W/cm2) was applied on the CAM vessels for 60 s. The ultrasound effect on the vessels was recorded by life imaging (5-MP HD-microscope camera, Leica®). The induced vessel diameter changes were evaluated in a defined time interval of 20 min using a Fiji macro. The vessel diameter before and after sonication was measured and the relative diameter reduction was determined. The first reduction of vessel diameter was observed after three minutes with an average vessel-diameter decrease to 77%. The maximum reduction in vessel diameter was reached eight minutes after sonication with an average vessel diameter decrease to 57% (mean relative diameter reduction of 43%, range 44-61%), ANOVA, p = 0.0002. The vasospasm persisted for all 20 recorded minutes post-induction. Vasospasm can be reliably induced by short application of 3 MHz-ultrasound to the CAM vessels. This might be a suitable in vivo model for the evaluation of drug effects on vasospasm in an experimental setting as an intermediary in the transition process from in vitro to in vivo assessment using animal models [1)].

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aimed to assess the concept of controlled drug release from nimodipine-loaded copolymers by ultrasound application in the chicken chorioallantoic membrane (CAM) model. Nimodipine-loaded copolymers were produced with the direct dissolution method. Vasospasm of the CAM vessels was induced by means of ultrasound (Physiomed, continuous wave, 3 MHz, 1.0 W/cm2). The ultrasound-mediated nimodipine release (Physiomed, continuous wave, 1 MHz, 1.7 W/cm2) and its effect on the CAM vessels were evaluated. Measurements of vessel diameter before and after ultrasound-induced nimodipine release were performed using ImageJ. The CAM model could be successfully carried out in all 25 eggs. After vasospasm induction and before drug release, the mean vessel diameter was at 57% (range 44-61%) compared to the baseline diameter (set at 100%). After ultrasound-induced drug release, the mean vessel diameter of spastic vessels increased again to 89% (range 83-91%) of their baseline diameter, which was significant (p = 0.0002). We were able to provide a proof of concept for in vivo vasospasm induction by ultrasound application in the CAM model and subsequent resolution by ultrasound-mediated nimodipine release from nanocarriers. This concept merits further evaluation in a rat SAH model [2)].

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Döring K, Schroeder H, Fischer A, Sperling S, Ninkovic M, Stadelmann C, Mielke D, Rohde V, Malinova V. In Vivo Vasospasm Induction by Ultrasound Application in the Chicken Chorioallantoic Membrane Model. Transl Stroke Res. 2022 Jan 21. doi: 10.1007/s12975-021-00960-y. Epub ahead of print. PMID: 35061211.
2)
Döring K, Sperling S, Ninkovic M, Schroeder H, Fischer A, Stadelmann C, Streit F, Binder L, Mielke D, Rohde V, Malinova V. Ultrasound-Induced Release of Nimodipine from Drug-Loaded Block Copolymer Micelles: In Vivo Analysis. Transl Stroke Res. 2022 Jan 5. doi: 10.1007/s12975-021-00979-1. Epub ahead of print. PMID: 34988870.