

· 基础研究 ·

次声暴露对血管内皮细胞骨架微丝 F-actin 表达的影响

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【摘要】目的 研究 16 Hz, 90, 110 及 130 dB 的次声作用对人脐血管内皮细胞 (ECV-304) 骨架 F-actin 表达的影响。**方法** 将 ECV-304 接种于细胞爬片上, 并将其分为对照组和 90, 110, 130 dB 次声暴露组。各次声暴露组均接受 2 h 相应强度的次声作用, 对照组则作次声假暴露处理。于次声作用后即刻、1 h、2 h、4 h、8 h、12 h 及 24 h 分别对各组细胞进行 F-actin 免疫荧光染色检测, 同时应用激光扫描共聚焦显微镜观察各组细胞 F-actin 的表达变化, 记录并测定其 F-actin 的平均荧光强度。**结果** 对照组细胞中的大部分荧光样物质呈弥漫状态, 胞膜荧光较强, 胞浆内可见少量肌动蛋白纤维丝, 方向不规则, 长短不一。即刻观察经不同声压级次声作用后的 3 组细胞, 均可见其胞浆中微丝 F-actin 明显粗大、变长, 其间的荧光样物质大多为较长的粗大应力丝, 沿细胞纵轴排列较多, 细胞数量及荧光强度明显增加, 细胞膜与对照组类似, 均结构完整且荧光增强; 在次声作用后 8 h 时, 各次声暴露组细胞的 F-actin 仍处于高表达状态; 随着时间的延长, 其 F-actin 表达逐渐降低; 当次声作用后 24 h 时, 各次声暴露组 F-actin 与对照组已无显著性差异。不同声压级次声暴露组细胞的 F-actin 变化趋势均基本一致, 3 组细胞的 F-actin 表达在各检测时间点均未见显著性差异。**结论** 16 Hz, 90 dB, 110 dB 及 130 dB 的短时次声暴露均可诱导人脐血管内皮细胞 F-actin 表达改变, 导致其骨架重建; 并且由短时次声作用诱发的细胞骨架改建可在次声暴露结束后 24 h 时恢复正常。

【关键词】 次声; 人脐血管内皮细胞; 聚合态肌动蛋白; 激光扫描共聚焦显微镜

Effects of exposure to infrasound on the expression of cytoskeleton filament F-actin in vascular endothelial cell-304 WANG Bing-shui, CHEN Jing-zao, GUO Guo-zheng, REN Dong-qing, LI Ling, ZENG Gui-ying, FANG Heng-hu, LIU Jing, CHEN Dan. Department of Rehabilitation, Xijing Hospital, The Fourth Military Medical University, Xian 710032, China

【Abstract】Objective To investigate the effects of exposure to infrasound of different intensities on the expression of F-actin in vascular endothelial cell-304 (ECV-304). **Methods** The ECV-304 primary culture cells were exposed to infrasound of 0 dB (the control group), 90 dB, 110 dB, 130 dB, respectively, for 2 hours. Laser scanning confocal microscope was used to examine the changes of F-actin after immunofluorescent staining at 0 h, 1 h, 2 h, 4 h, 8 h, 12 h and 24 h after treatment and the photos were taken for further analysis of the cell average fluorescence. **Results** In the control group, most fluorescein-labelled substance was scattered in the cells, and few actin filaments were observed with irregular alignment, while the expression of F-actin in the experimental groups was thicker, longer and showed in longitudinal arrangement after exposure, and the intensity of fluorescence was significantly increased. In all groups, complete and strong fluorescence was observed at cellular membrane. The over-expression of F-actin in the experimental groups was kept obviously for 8h, however there was no significant difference of the F-actin expression between the experimental groups and the control group 24 h later. The expression of F-actin in all the experimental groups was synchronous, and there was no obvious difference at each time point. **Conclusion** F-actin expression in ECV-304, exposed to infrasound with intensity output of 90 dB, 110 dB, 130 dB and frequency of 16 Hz, could be changed, and recuperated 24 h after infrasound exposure.

【Key words】 Infrasound; ECV-304; F-actin; Laser scanning confocal microscope

次声是频率为 0.000 1 ~ 20 Hz 的一类声波, 它广泛存在于自然、军事、工业生产、交通以及人体环境中, 人耳一般不能察觉, 但次声可对人体产生多种生物学效应^[1]。近年来涉及次声生物学效应的研究逐渐增多, 并

发现一定声压级的次声可对中枢神经系统、心血管系统、呼吸系统、听觉系统、生殖系统及多种器官功能产生影响, 但其诱发细胞内生物学效应的途径目前尚不清楚。微丝骨架是细胞骨架的一种, 与诸如维持细胞形态、参与细胞分裂、细胞运动、细胞内物质转运及信号转导等多种功能密切相关; 一般认为细胞外基质-整合素-细胞骨架轴是细胞感受外界机械信号并将其转化为生化信号的主要途径^[2-4]。本研究观察了经不同声压级次

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