

论著

复频高强度聚焦超声对离体细粒棘球蚴囊壁超微结构的影响

刘婧¹, 王炜^{2, 3}, 景涛^{1, 2 *}, 包根书¹, 王欣¹

1 兰州大学病原生物学研究所, 兰州 730000; 2 甘肃省新药临床前研究重点实验室, 兰州 730000;
3 兰州大学生物医学工程研究所, 兰州 730000

收稿日期 修回日期 网络版发布日期 接受日期

摘要

目的 分别用单频和多频聚焦超声体外照射细粒棘球蚴包裹, 观察对其囊壁的损伤情况。方法 用羊肝细粒棘球蚴原头节接种小鼠, 1年后处死, 自腹腔取出包裹, 选择直径约2 cm的包裹40只随机均分4组。对照组剪破包裹壁, 用3%戊二醛固定并立即冷藏。实验A组包裹用2号单频换能器(4 W)照射, 实验B组用2及3号双频换能器(功率分别为4和5 W)同时照射, 实验C组用1、2及3号3频换能器(功率分别为4、4及5 W)同时照射。各组均照射1 min, 然后立即用3%戊二醛固定并冷藏。用肉眼、扫描电镜及透射电镜观察其变化。结果 肉眼见实验组囊壁变厚, 颜色浑浊。透射电镜观察显示, 随超声频数增加囊壁结构被破坏程度加重, 角皮层纤维增粗、紊乱, 生发层细胞核肿胀破裂, 线粒体明显受损, 微绒毛变短, 断裂或消失。部分区域仅剩细胞碎片和破裂的细胞核。扫描电镜观察显示, 随超声频数增加, 囊壁内外表面被破坏程度加重, 最终正常结构被完全破坏。结论 在体外, 复频高强度聚焦超声对小鼠细粒棘球蚴囊壁损伤明显, 其损伤程度随超声频数的增加而加重。

关键词 [复频聚焦超声波](#); [细粒棘球绦虫](#); [棘球蚴囊](#); [扫描电镜](#); [透射电镜](#)

分类号

In vitro Influence of Multi-frequency Focused Ultrasound on the Ultrastructure of *Echinococcus granulosus* Hydatid Cysts

LIU Jing¹, WANG Wei^{2, 3}, JING Tao^{1, 2 *}, BAO Gen-shu¹, WANG Xin¹

1 Institute of Pathogenic Biology, Lanzhou University, Lanzhou 730000, China; 2 Key Laboratory of Preclinical Study for New Drugs of Gansu Province, Lanzhou 730000, China; 3 Institute of Biomedical Engineering, Lanzhou University, Lanzhou 730000, China

Abstract

Objective To investigate the change of *Echinococcus granulosus* hydatid cysts *in vitro* treated with single-frequency and multi-frequency focused ultrasound. Methods Mice were inoculated with echinococcus protoscolices from infected sheep, and sacrificed after one year. Forty cysts (about 2 cm in diameter) were taken from infected mice, and randomly divided into four groups. Cysts in the control group were immediately opened, fixed with 3% glutaraldehyde solution, and frozen. Cysts in groups A, B and C were treated with transducer No. 2 (4 W), transducer No.2 (4 W) +No. 3 (5 W), and transducer No.1 (4 W) +No. 2 (4 W) +No. 3 (5 W), respectively. After irradiated for 1 minute, the cysts were all fixed and refrigerated, then observed by naked eyes, transmission electron microscopy and scanning electron microscopy. Results The wall of hydatid cyst in the experimental groups became thicker and less transparent. Images from the transmission electron microscopy showed more serious damage of cyst wall with the increase in ultrasonic power and irradiation time. The fiber of the laminated layer became thicker and disordered, the nucleus in germinal layer became swollen and broken, the mitochondria were destroyed remarkably and the microvillus got shorter, fractured or even disappeared. In some occasions, only cell debris and broken nucleolus left. Scanning electron microscopy also demonstrated that with the increase in ultrasound power and irradiation time, the damage of the cyst wall became more serious even the normal structure was completely destroyed. Conclusion Multi-frequency focused ultrasound causes significant damage of the *Echinococcus granulosus* hydatid *in vitro*, and the damage level is related to the ultrasound power and irradiation time.

Key words [Multi-frequency focused ultrasound](#); [Echinococcus granulosus](#); [Hydatid cyst](#); [Scanning electron microscopy](#); [Transmission electron microscopy](#)

DOI:

通讯作者 景涛 jtao@lzu.edu.cn

作者个人主页 刘婧¹; 王炜^{2, 3}; 景涛^{1, 2 *}; 包根书¹; 王欣¹

扩展功能

本文信息

▶ [Supporting info](#)

▶ [PDF\(491KB\)](#)

▶ [\[HTML全文\]\(OKB\)](#)

▶ [参考文献\[PDF\]](#)

▶ [参考文献](#)

服务与反馈

▶ [把本文推荐给朋友](#)

▶ [加入我的书架](#)

▶ [加入引用管理器](#)

▶ [复制索引](#)

▶ [Email Alert](#)

▶ [文章反馈](#)

▶ [浏览反馈信息](#)

相关信息

▶ [本刊中包含“复频聚焦超声波; 细粒棘球绦虫; 棘球蚴囊; 扫描电镜; 透射电镜”的相关文章](#)

▶ 本文作者相关文章

• [刘婧](#)

• [王炜](#)

•

• [景涛](#)

•

• [包根书](#)

• [王欣](#)