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## 经多功能心腔内超声导管超声辐照破坏微泡对犬心肌组织的生物学效应

### Bioeffects on canine myocardium under microbubbles destruction using multifunctional intracardiac echocardiography catheter

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中文摘要:

目的 观察经多功能心腔内超声(ICE)导管超声辐照破坏微泡对动物心肌产生的生物学效应,探索基因治疗缺血性心脏病的新方法。方法 15只犬随机分为US+MB组、US组、对照组,每组5只。以介入法将多功能ICE导管送入犬心室。对US+MB在ICE监控下向左心室游离壁注射0.5 ml微泡,并以1 W/cm<sup>2</sup>的声能对注射部位辐照1 min;对US组以相同条件行左心室壁辐照,但射微泡;对照组在插入导管后不进行任何处理。术后3天处死动物,观察心肌组织大体改变,并行HE染色观察细微结构变化。结果 ICE能对注射针的进针深度、微泡注射及辐照过程进行实时监控。观察期内所有动物均正常存活。US+MB组心肌辐照部位出现充血、心肌细胞间隙增宽、少量炎性细胞浸润等改变,US组心肌组织仅出现轻微充血;对照组动物心肌无异常变化。结论 ICE导管超声辐照破坏微泡能在靶区域产生相应生物学效应,内置ICE可对心肌内微泡注射、超声辐照过程进行实时监控。此款新型多功能导管可能为基因治疗缺血性心脏病提供新的、安全有效的途径。

英文摘要:

**Objective** To explore the bioeffects on canine myocardium under microbubbles destruction using multifunctional intracardiac echocardiography (ICE) catheter, in order to investigate a new way for treatment of ischemic heart disease. **Methods** Fifteen canines were randomly allocated to ultrasound+microbubble group, ultrasound group and control group, each group had 5 animals. The catheter was delivered into the left ventricle using interventional method. Ultrasound irradiation (1 W/cm<sup>2</sup>) was applied to expose canine myocardium for 1 min after intramyocardial injection of 0.5 ml microbubble ultrasound + microbubble group. Animals in ultrasound group only received ultrasound irradiation, and the other 5 animals in control group accepted catheterization only. All the animals were killed 3 after operation. The myocardium was harvested for HE staining and observed with microscope. **Results** The depth of the injection needle, the procedure of microbubbles injection and irradiation could be monitored by ICE imaging. All animals survived during follow-up period. The myocardium of hyperemia, myocardial cell gaps widen, pale cytoplasm dyed and microvascular wall burst could be seen in ultrasound+microbubble group. The myocardium of hyperemia was relative slight in ultrasound group and without any exception appearance in control group. **Conclusion** Ultrasound mediated microbubbles destruction using this multifunction catheter can induce corresponding bioeffects. ICE imaging can achieve monitoring of intramyocardial injection of microbubbles and provide information of ultrasound irradiation. This multifunctional intracardiac echocardiography catheter may provide a new, safe and more effective strategy for gene treatment of ischemic heart disease.

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