中国医学影像技术
CHINESE JOURNAL OF MEDICAL IMAGING TECHNOLOGY

任静,王芳,杨勇,魏光全,张瑞,杨安钢,刘莹,宦怡.前列腺干细胞抗原特异性分子探针的构建及其在体MR成像的实验研究[J].中国医学影像技术,2011,27(3):437~443

前列腺干细胞抗原特异性分子探针的构建及其在体MR成像的实验研究

Experimental study of prostate stem cell antigen specific MR molecular probe and in vivo MRI in nude mice model grafted with human prostatic cancer

投稿时间：5/5/2010　最后修改时间：11/24/2010

DOI：

中文关键词： 前列腺肿瘤;分子成像;纳米微粒;磁共振成像;前列腺干细胞抗原蛋白　人

英文关键词: Prostatic neoplasms;Molecular imaging;Nanoparticles;Magnetic resonance imaging;PSCA protein　human

基金项目: 国家自然科学基金(30470511)。

作者	单位	E-mail
任静	第四军医大学西京医院放射科,陕西 西安 710032	
王芳	第四军医大学基础部生物化学与分子生物学教研室,陕西 西安 710032	
杨勇	第四军医大学西京医院放射科,陕西 西安 710032	
魏光全	第四军医大学西京医院放射科,陕西 西安 710032	
张瑞	基础部免疫学教研室,陕西 西安 710032	
杨安钢	基础部免疫学教研室,陕西 西安 710032	
刘莹	第四军医大学西京医院放射科,陕西 西安 710032	
宦怡	第四军医大学西京医院放射科,陕西 西安 710032	huanyi3000@163.com

中文摘要：

目的 应用纳米金磁微粒标记抗人前列腺干细胞抗原(PSCA)单抗7F5,构建PSCA特异性MR分子探针7F5@GoldMag,检测其与前列腺癌细胞结合的特异性,并探讨其用于前列腺癌体外及体内MR成像的可行性。**方法** 应用非共价键耦联方法将纳米金磁微粒标记7F5,构建PSCA特异性MR分子探针7F5@GoldMag,检测其与前列腺癌细胞结合的特异性;应用3.0T磁共振扫描仪,观察不同浓度金磁微粒MR成像情况,探讨MRI可分辨的最低浓度;培养人前列腺癌细胞PC-3和肝癌细胞SMMC-7721,将这两种细胞分别与7F5@GoldMag、无关抗体@GoldMag交叉配对,对各组细胞行T2WI并分别测量其信号强度。建立PC-3和SMMC-7721荷瘤裸鼠模型,对两组荷瘤裸鼠经尾静脉注射7F5@GoldMag和无关抗体@GoldMag,分别在注射前、注射后6、12和24 h行MR扫描,观察其对肿瘤T2WI信号的影响,分别测量其信号强度,探讨其用于MR体内成像的可行性,分析比较其信号强度的差异。**结果** 成功构建PSCA特异性MR分子探针7F5@GoldMag;流式细胞术检测其与PC-3细胞结合率为92.11%;激光共聚焦显微镜及透射电镜观察见PC-3细胞与7F5@GoldMag有特异性结合。纳米金磁微粒稀释至1 ∶ 640,与1%琼脂糖凝胶相比,T2WI信号强度差异有统计学意义;7F5@GoldMag可显著特异性降低PC-3细胞T2WI信号。PC-3荷瘤裸鼠注射7F5@GoldMag 6、12和24 h后肿瘤组织T2WI信号强度较平扫显著降低($F=43.675$, $P<0.05$)。而SMMC-7721荷瘤裸鼠在平扫和注射对比剂后6、12和24 h肿瘤信号强度差异无统计学意义。**结论** PSCA特异性MR分子探针7F5@GoldMag具有良好的理化性质和免疫活性,可特异性降低PC-3细胞的T2WI信号,对活体前列腺癌组织具有靶向性的增强效果。

英文摘要：

Objective To construct the prostate stem cell antigen (PSCA) specific MR molecular probe 7F5@GoldMag, and to examine its biochemical characteristics, in order to investigate the feasibility of MRI of 7F5@GoldMag in prostatic cancer using a clinical 3.0T MR system in vitro and in vivo. **Methods** PSCA specific MR molecular probe 7F5@GoldMag was constructed using conjugating anti-human PSCA mAb 7F5 with GoldMag^{TM}-CS nanoparticles, and the coupling efficiency was calculated. The specific binding capability for 7F5@GoldMag to prostatic cancer cells was detected using laser confocal microscopy, transmission electron microscope and flow cytometry. GoldMag^{TM}-CS nanoparticles solution in different concentration was scanned to ascertain the lowest concentration that can be detected with MR system. Prostatic cancer cell line PC-3 and hepatic cell line SMMC-7721 were cultured (the later was control group) and nude mice models were established. The two cell lines were cross-matched with 7F5@GoldMag and non-related IgG@GoldMag. T2 weighted images were obtained and the signal intensity was measured in each group. After conventional scan, T2 weighted images were obtained after the probe was injected into nude mice model through caudal vein 6, 12 and 24 h later, respectively. Statistical analysis were performed to assess the statistical differences of tumor signal intensity. **Results** PSCA specific MR molecular probe (7F5@GoldMag) was successfully constructed. The results of laser confocal microscopy, transmission electron microscope and flow cytometry proved that 7F5@GoldMag could specific bind with PC-3 cells. T2WI signal intensity of GoldMag^{TM}-CS was significantly lower than that of agarose gel even if the former was diluted by 640 times. 7F5@GoldMag could specifically decrease T2WI signal intensity of PC-3 cells in vitro. After 7F5@GoldMag was injected into nude mice model through caudal vein 6, 12 and 24 h later, T2WI signal intensity of PC-3 tumor was significantly lower than that of conventional scan ($F=43.675$, $P<0.05$). The signal intensity of control groups did not show significant difference. **Conclusion** PSCA specific MR molecular probe is successfully constructed by conjugating anti-human PSCA mAb 7F5 with GoldMag^{TM}-CS nanoparticles, which can specifically bind with PC-3 cell and has target-directed enhancement effect in PC-3 cell line in vitro and in nude mice model grafted with PC-3 in vivo using a clinical 3.0T MR scanner.

关闭