

抗体複合化 Gd ナノ粒子造影剤による未分化 iPS 細胞の *in vitro* MRI 検出

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In vitro MRI detection of undifferentiated iPS cells by using Gd nanoparticulate contrast agents with antibodies (¹Graduate School of Engineering, Kyoto University, ²RIKEN, ³Kyoto University Hospital, ⁴Graduate School of Informatics, Kyoto University) ○Shinji Suzuki,¹ Yu Kimura,¹ Hidetoshi Masumoto,^{2,3} Hirohiko Imai,⁴ Kozue Murata,^{2,3} Kenji Minatoya,³ Teruyuki Kondo¹

Induced pluripotent stem cells (iPSC) are expected to play an important role in regenerative medicine because they have capability to differentiate into various tissue cells and have relatively little immune response. On the other hand, iPSC are known to have tumorigenicity in their undifferentiated state, and tumorigenesis after the transplantation, which caused by remaining undifferentiated iPSC, has been difficulties in the realization of regenerative medicine. In this study, we focused on the surface antigens of iPSC, and dextran-modified GdPO₄ nanoparticles conjugated with their antibodies were developed as an MRI contrast agent for detection of undifferentiated iPSC.

As a result, longitudinal relaxation rate (r_1) of water proton with the synthesized antibody-conjugated nanoparticles was clearly showed that they are effective as a positive contrast agent. Then, the interaction between antibody-conjugated nanoparticles and undifferentiated iPSC was much higher than that of nanoparticles without antibodies. Furthermore, T1-weighted MR images of the iPSC cluster showed that the brightness of the cells with the antibody-conjugated nanoparticles was enhanced, which indicates possibility to detect undifferentiated iPSC.

Keywords : *Imaging; iPS cells; MRI; Gd; Nanoparticles*

人工多能性幹細胞 (iPSC) は、さまざまな組織細胞に分化可能であり、免疫反応も低いことから、再生医療において重要な役割を担うことが期待されている。一方、未分化状態の iPSC は、腫瘍形成能を有することが知られており、残存する未分化 iPSC に起因する移植後の腫瘍化が再生医療の実現に向けた大きな課題である。本研究では、iPSC に特徴的な表面抗原に着目し、抗体を複合化したデキストラン被覆 GdPO₄-MRI ナノ粒子造影剤の開発を行った。

合成した抗体導入ナノ粒子の水分散液について、水 ¹H の縦緩和能 r_1 を測定した結果、陽性造影剤として有効であることが明らかになった。また、抗体導入ナノ粒子を未分化 iPSC (836B3 株) 細胞塊に暴露後、原子吸光光度計により細胞へのナノ粒子結合量を測定した結果、抗体を導入していないナノ粒子より、遥かに結合量が多いことが明らかになった。さらに、この細胞塊の T1 強調 MRI 撮像により、抗体導入ナノ粒子を添加した細胞の輝度が向上し、未分化 iPSC の MRI 検出が可能であることがわかった。