Usability of In Vivo Imaging System to Detect Biodistribution of Human Mesenchymal Stem Cells in Mice

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In Vivo Imaging System (IVIS) can visualize the localization of transplanted cells in whole animal bodies or organs by labeling the cells with fluorescence.

Although Immunohistochemistry (IHC) and real-time PCR (qPCR) are common methods for analyzing biodistribution of transplanted cells, these methods require excised organs, which makes whole body analysis labor-intensive and expensive. On the other hand, IVIS can visualize the migration of biodistribution over time in a whole body of a living animal, and also provides visual information about uneven distribution of cells in an organ.

To assess the usefulness of IVIS in biodistribution studies in rodents, we injected hMSC into NOG mouse through tail vein, and compared the biodistribution data generated by IVIS, qPCR, and IHC.

Results of IVIS and qPCR were confirmed as to whether they reflected intact human cells by performing IHC. Intact human cells were detected in the lung where high intensity was observed in both IVIS and qPCR, but were not detected in the liver where low intensity was observed in both methods.

It is possible that intact human cells were not included in the sliced specimen since the number of cells was not sufficient, or the cells were disrupted or not distributed.

Conclusions

IVIS: Enables non-invasive time-course analysis in a live animal
- Provide visual localization information
- Comprehensive analysis of whole body and excised organs

qPCR: Quantitative analysis
- High sensitivity

IHC: High sensitivity (cellular level)
- High specificity

Our data suggest that IVIS may have background fluorescence issues, which require more studies to be a reliable quantitative method. However, IVIS can non-invasively visualize the localization and migration of transplanted cells over time in a whole animal body and organs with relatively low cost, which cannot be achieved by other methods. In addition, ex vivo IVIS imaging provides information on uneven distribution of transplanted cells in an organ.

Thus, IVIS can be a useful method to select target organs, collection methods, and collection time-points for qPCR and IHC. We suggest that IVIS can be a powerful method for biodistribution studies when combined with qPCR or IHC.