Stem Cell Imaging with MRI

Stem Cells

Stem cells are highly specialized cells that are the foundation for every organ and tissue.

Two key properties of stem cells are the ability to self-renew and the ability to differentiate. Specific types of stem cells used in stem cell therapies are tissue-specific and embryonic.[1]

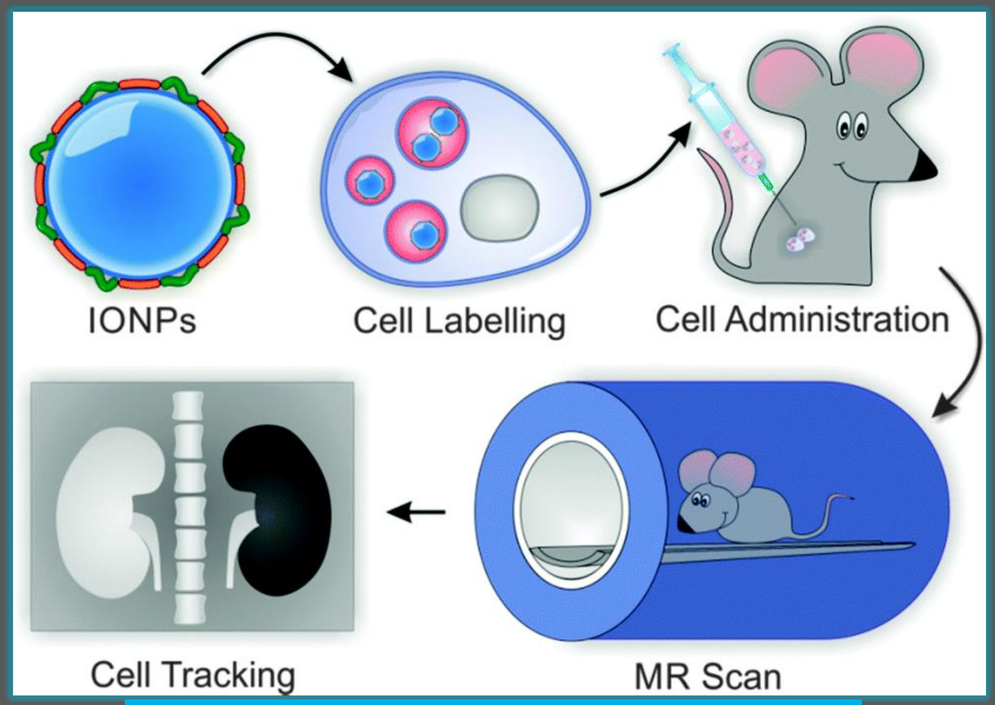
Stem Cell Therapy

Stem cell therapy offers a promising way to treat diseases because of the stem cell's ability to differentiate into specialized cell types and derive into new tissue to replace damaged tissue.[1] Stem cell therapy is in its infancy, and there are many barriers identified after the cell is transplanted. Molecular imaging with MRI helps to get a better understanding of the cells fate after transplantation through a process called cell tracking.[2,3]

Types of Labeling

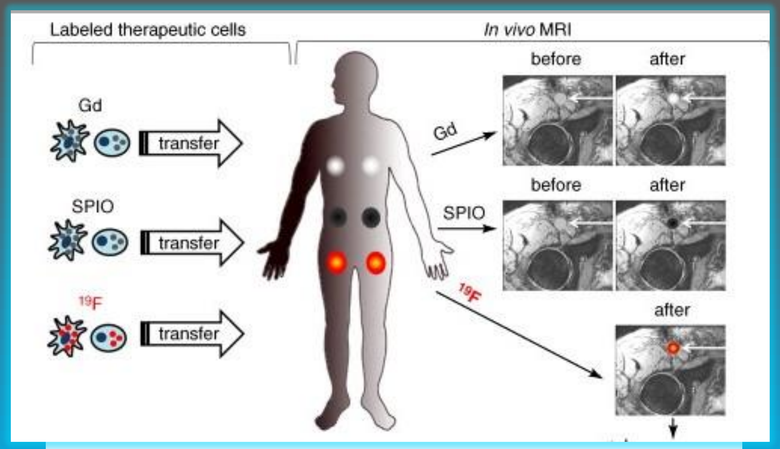
- Direct cell labeling consists of stem cells coated with superparamagnetic iron oxide nanoparticles (IONP) before being transplanted in vivo.[2,3]
- Reporter gene imaging consists of encoding a protein which later metabolizes a substrate which in turn produces a signal that can be detected.[2,3]

Stem Cell Tracking Sequence



The labeling and tracking of stem cells by molecular imaging helps to assure accurate stem cell implementation. It also provides a way to monitor the progress of the cell.[2]

MRI Tracking



MRI stem cell tracking involves the "labeling of cells with a probe or contrast agent that allows them to be distinguished from the host cells." [4]

Barriers Identified by MRI Tracking

Molecular imaging is vital to identifying those barriers and for successful transplantation results by tracking cells after they have been transplanted. Some barriers identified are as follows:

- **Unsuccessful Cell Engraftment, Survival and Proliferation**
- **Limits in the Differentiation and Development of the Cell**
- **Rejection of Cell in New Environment**
- **Pluripotent Cells Mutating into Tumors** [2]

Conclusion

The potential for stem cell therapies with MRI cell tracking are boundless. MRI is one of the leading choices for cell tracking because its high spatial resolution, ability to produce three-dimensional images, and details with tissue images. More research and comprised clinical data is needed before certain stem cell therapies like neurological and cardiac can be done on humans.[4]

Works Cited

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