

# Cell Delivery

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## Highlights:

- \*With cell therapy entering the clinic, accurate cell delivery is of paramount importance
- \*MR-guided injections are the preferred method of choice to verify accurate delivery
- \*Interventional radiologists performing these procedures will need to be educated in the areas of molecular and cellular imaging

Cellular therapeutics have recently emerged as a new way to treat or possibly cure a myriad of diseases. This includes the use of immune cells including dendritic cell cancer vaccine for immunotherapy of cancer, and the use of progenitor and stem cells for repair of degenerative diseases. Cellular therapies can take advantage of image-guided delivery to enhance the delivery process. Although some cellular therapies are adequately managed with systemic delivery, certain organs and conditions require a targeted approach for maximum affect. In fact due to the anatomical constraints of the vascularity of specific organs, systemic therapy is precluded and image guided techniques will be necessary to overcome some of these barriers. For examples, the vasculature of the brain, liver and pancreas have been shown to have unique anatomical boundaries that create a barrier to conventional therapies and therefore do not respond to conventional systemic therapies. With the brain, the blood brain barrier acts as a physiologic barrier that prevents the migration and the transport of agents from the systemic vasculature. With the both the liver and pancreas, there is a separate anatomic venous vascular supply, termed porto-mesenteric system, that is completely isolated from systemic circulation. Therefore, with disorders involving these organs (i.e. stroke, cirrhosis, and diabetes) accessing these secluded organs will be critical to the success of such cellular therapeutics.

Another relevant opportunity with image-guided cell delivery is the ability to not only deliver to target organs but also have the ability to administer only into injured tissues. As demonstrated by multiple studies, substantial mobilization of stem cells has been demonstrated after myocardial infarction and also with liver injury. Clearly the homing of cells to injured tissues is a major mechanism of regeneration and there has been extensive work in utilizing image-guided therapy to help foster this process by providing targeted delivery into injured tissue. Fluoroscopic (X-ray) injections are currently the prevalent method in the clinic, but a major limitation with this method is that anatomical information, which is derived from x-ray images, is two-dimensional and has substantial anatomic ambiguity.

MR image-guided injections provide a new delivery alternative to conventional x-ray approaches. The advantage of MRI over x-ray is that it is a tomographic technique allows one to view multiple planes rather than projections, with excellent soft tissue contrast, the ability to monitor vascularization and, most importantly, the use of MR-labeled (fluorine or iron oxide) cells. Although most studies to date have been proof-of-principle, it is anticipated that MR imaging and guidance techniques will provide unique insights into the complex dynamics of cellular therapies and, thus, enhance these techniques for clinical implementation.