Stem Cell Therapy From Your Furry Friends To You!

By Kaitlin Clark

Stem cell therapy has gone to the animals! Did you know that at the UC Davis Veterinary Medicine Teaching Hospital (VMTH) there is currently a clinical regenerative medicine laboratory (RML) that can provide stem cell therapy to your beloved pet? The UC Davis RML is one of the only academic institutions in the nation to provide clinical veterinary stem cell services.

The RML opened its doors in 2007. Initially only treating horses, the lab has grown immensely in the past few years and is now also catering to dogs and cats. Stem cell therapy has proven to be a great therapeutic option for many diseases that affect all types of animal patients.

The potential benefits of veterinary stem cell therapy does not only serve our furry cliental. Horses, cats, dogs and many other animals serve as great model organisms for human diseases. You may have heard of scientists using mouse models in their laboratories to mimic human diseases. But large animals are considered to be superior models because they suffer from naturally occurring diseases that are similar to humans. For instance, sport horses frequently suffer from cartilage, ligament and bone injuries that resemble injuries common to human athletes. Instead of creating an artificial injury in mice, we can use animal patients that naturally suffer from any particular injury or disease. In addition, large animals are often more genetically similar to us than mice or lower vertebrates, so these animal patients serve as better examples for new therapies that might eventually be used later down the line for humans.

At the UC Davis veterinary clinic, we use adult derived mesenchymal stem cells (MSCs) as a form of stem cell therapy to treat horses. One great feature of MSC- based therapies is that we can use a patient's own stem cells to treat them! This makes it less likely that the animal's immune system would react to a cell-based therapy – because the cell-based therapy would be completely composed of that animal's own cells. In addition, MSCs can be isolated with minimal invasiveness from bone marrow, fat or umbilical cord blood, and tissue.

Let's use an example. Imagine a horse comes into the clinic with a ligament injury. Veterinarians could collect a small piece of fat for MSC isolation. That fat would take about two weeks to be processed and viola! MSCs would be ready to inject into that patient's injury site to promote healing of the ligament.

So now you know we can use MSCs for clinical applications in a horse, but what do we know about how these stem cells work? In the laboratory of Dr. Dori Borjesson we found that MSCs collected from different tissues in horses have the ability to inhibit inflammation. The inhibition of inflammation can promote healing in damaged tissues. But we want to understand *how* the MSCs work to suppress inflammation. We have examined a host of inflammatory proteins (molecules that cause inflammation) and are just starting to uncover the mechanism by which horse MSCs work their magic. The short answer [for now] is that for everything we do know, there is still a lot we have yet to learn. So MSC research presses on!

But now you may ask yourself, what is the benefit of using stem cells as opposed to some other type of anti-inflammatory drug like aspirin? The answer to this is regeneration! Regeneration refers to the process of re-growing tissue that has been lost or damaged. Stem cells have the ability to divide indefinitely, meaning they can produce new cells. These cells produced of stem cells can develop into many different cell types. MSCs, which come from adult tissues, can develop into a

number of cell types, including bone, cartilage, fat, and other connective tissue types. This varied developmental potential means MSCs may be useful for a variety of different treatments

One outstanding question regarding MSCs utility as therapeutic tools is that we still do not know how long MSCs remain at a injury site once implanted. We need to be certain that MSCs will persist long enough to regenerate damaged tissues. This specific question is the aim of our current research.

First, we want to provide data that shows horse MSCs inhibit inflammation within the animal. We know MSCs can do this in a petri dish, but it is important to make the connection from petri dish-results to real-life effects. My research design is to identify biomarkers, or biological indicators, of different disease states and then track these markers in response to MSC therapy. We are currently investigating different diseases in horses that involve bone, ligament and cartilage, which all parallel injuries that human athletes frequently suffer from. We are examining blood biomarkers sampled from a vein at the injury site (the foot), and also from a general circulating vein in the horse's neck. Biomarkers sampled closer to the injury site will help us understand how the body is responding locally to the disease or injury. Biomarkers examined further away (in this case, the neck) may not be detectable or accurately reflect what is happening right at the site of injury.

We hope our research will help the field better understand the biological process associated with injury or disease, as well as provide information about the role of MSCs as a therapeutic intervention. This study will provide the first evidence that stem cell therapy in horses can alter the disease state and inhibit inflammation. It may even give insights into the molecular basis of MSC regeneration. While this study will directly improve the use of stem cell therapy in animals, it could also help improve or expand the use of stem cells in human medicine.

When we combine veterinary and human medicine and work together as a team, we can speed up the pace of research aimed at generating stem cell therapies. This benefits our furry friends, as well as the rest of us. Just imagine, in the next 10 years, you may be able to get stem cells to treat that knee injury that never healed. With veterinary and human scientists working together the possibilities are endless!