

Lec 5\ Animal models in stem cell therapy

م. م ساره رحيم حمزه



Stem cells play an important role in veterinary medicine in different ways. Currently several stem cell therapies for animal patients are being developed

animal models are widely used to study the properties and potential of stem cells for possible future applications in human medicine

field of stem cell research, **human** and veterinary **medicine** are tied to one another.

The stem cell field in veterinary medicine continues to evolve rapidly **both experimentally and clinically**.

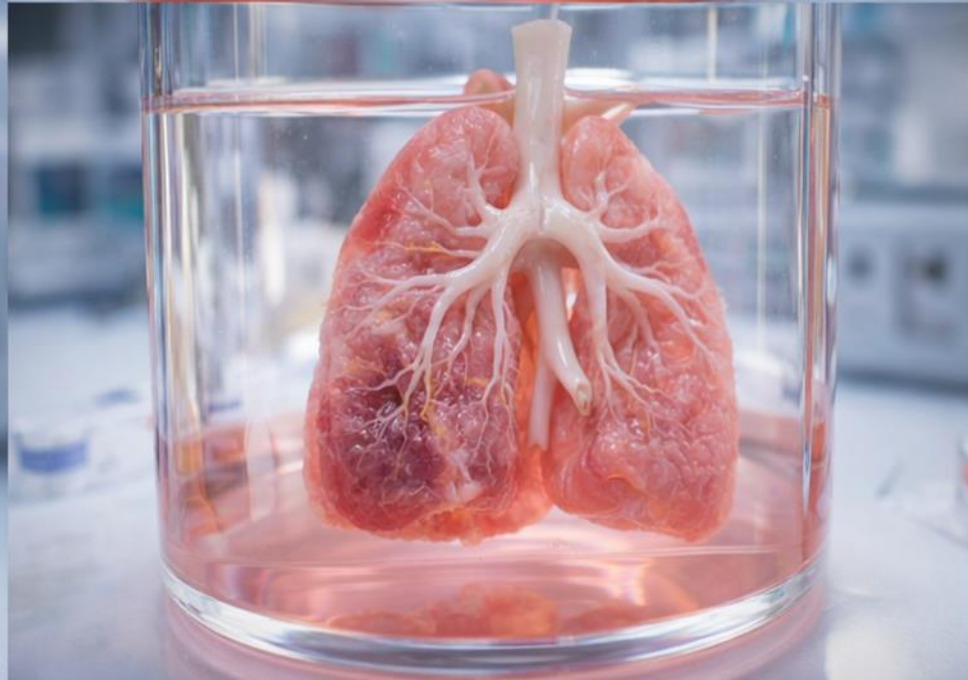
Stem cells are most commonly used in clinical veterinary medicine in **therapeutic** applications for **the treatment of musculoskeletal injuries in horses and dogs**.

-**New technologies** of assisted reproduction are being developed to apply the properties of **spermatogonial stem cells to preserve endangered animal species**.

-The same methods can be used to **generate transgenic animals** for production of **pharmaceuticals** or for use as **biomedical** models.

Small and large animal species serve as valuable models for **preclinical evaluation** of stem cell applications in human beings and in veterinary patients in areas such as **spinal cord injury** and **myocardial** infarction.





animal models in stem cell therapy

-in stem cell therapy, common disease animal models include mouse, rat, rabbit, swine, canine, caprine, equine and dolphin are used.

-Whereas for clinical models, canine, equine and dolphin are used.



From Where Stem Cell Harvesting

stem cells are generally harvested from bone marrow (femur of dogs and cats, sternum of horses)

-adipose tissue

-inguinal region of dogs and cats منطقة الأربية لدى الكلاب والقطط

- dorsal surface of the gluteus maximus of horses.

السطح الظهري للعضلة الألوية الكبرى لدى الخيول.

Why Does Adipose Tissue use?

1. Adult stem cells are **highly concentrated** in adipose tissue (fat).
2. Fat is also readily available in **large quantities** and **easily accessible**.
3. The **technique** to acquire the stem cell is less invasive and less **painful than aspirating a bone marrow sample** from the **hip** or the **sternum**.
4. There are up to **1,000 times** more stem cells in a **gram of fat** than in a gram of **bone marrow**.

-At this concentration , the procedure provides an:

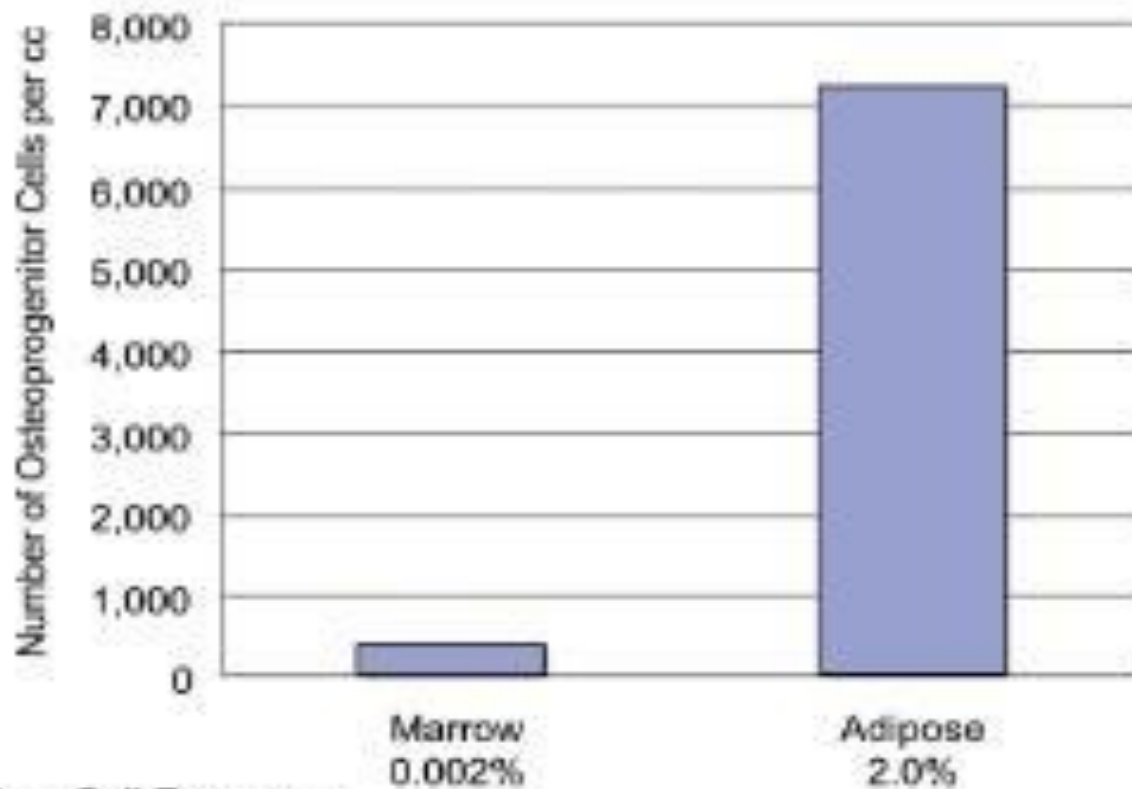
abundance of stem cells to treat in-clinic, **same day without the need** and additional expense of an outside culturing facility.

* Stem cells are extracted from the fat among a mixture of cells termed the **Stromal Vascular Fraction (SVF)**.

* The SVF is rich in :

complementary cells and bioactive peptides that contribute to cell proliferation and tissue regeneration, and also impart anti-inflammatory effects.

Bone Marrow vs. Adipose



Progenitor/Stem Cell Frequency

Accordingly, stem cells derived from bone marrow aspirates, for instance, are cultured in specialized laboratories for expansion to millions of cells.

-Although adipose-derived tissue also requires processing prior to use, the culturing methodology for adipose-derived stem cells is not as extensive as that for bone marrow-derived cells.

New sources of mesenchymal stem cells

New sources of mesenchymal stem cells are being researched, including stem cells present in

- **the skin and dermis** which are of interest because of **the ease** at which they can be harvested with minimal risk to the animal.
- **Hematopoietic stem cells** have also been discovered to be travelling in the blood stream and possess equal differentiating ability as other mesenchymal stem cells,
- again with a very non-invasive harvesting technique

There has been more recent interest in the use of **extra embryonic mesenchymal stem cells**. Research is underway to examine the differentiating capabilities of stem cells found in the

- **umbilical cord,**
- **yolk sac and**
- **placenta of different animals.**

-these stem cells are thought to **have more differentiating ability than their adult counterparts, including the ability to more readily form tissues of endodermal and ectodermal origin**

Stem cells are thought to mediate repair via five primary mechanisms:

1 -providing an anti-inflammatory effect.

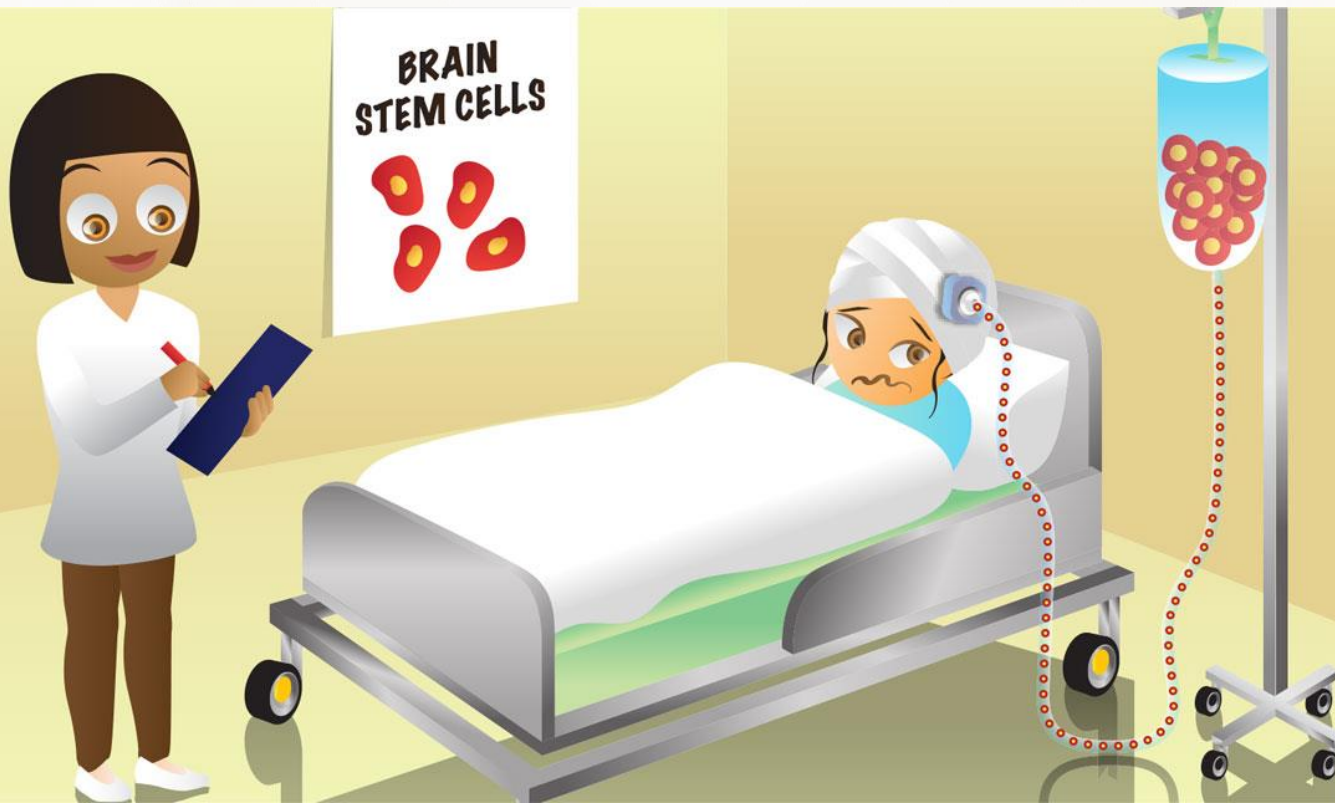
2 -homing to damaged tissues and attracts other cells, such as endothelial progenitor cell, that are necessary for tissue growth

3 -supporting tissue remodeling over scar formation .

4 -inhibiting apoptosis .

5 -differentiating into bone, cartilage, tendon, and ligament tissue .

- To further enrich blood supply to the damaged areas, and consequently promote tissue regeneration, **platelet-rich plasma** could be used in conjunction with stem cell transplantation.



Why utilize Platelet Rich Plasma with Stem Cell therapy?

Platelet Rich Plasma or PRP allows for an adjunctive autologous value add to the stem cell fraction.

-Platelet Rich Plasma is derived from a autologous whole blood sample from the patient and once processed **yields many healing growth factors.**

- **PRP can help with :**

-survival of the cells upon introducing to the patient,

-reduce inflammation

-as well as provide cyto-protective properties when transit is necessary

