INTRODUCTION

Avascular necrosis of the femoral head (AVN) is a pathologic process that results from interruption of blood supply to the bone. It is poorly understood, but this process is the final common pathway of traumatic or nontraumatic factors that compromise the already precarious circulation of the femoral head. Femoral head ischemia results in the death of marrow and osteocytes and usually results in the collapse of the necrotic segment ***(Kelly & Wald, 2007).***

AVN of the femoral head is an increasingly common cause of musculoskeletal disability, and it poses a major diagnostic and therapeutic challenge. Although patients are initially asymptomatic, AVN usually progresses to joint destruction, requiring total hip replacement (THR), usually before the fifth decade ***(Aiello, 2008).***

As osteonecrosis may be a disease of mesenchymal cells or bone cells, the possibility has been raised that bone marrow containing osteogenic precursors implanted into the necrotic lesion could be of benefit in this condition ***(Gangji, Toungouz et al., 2005).***

A stem cell is a cell that has the ability to divide (self replicate) for indefinite periods often throughout the life of the organism. Under the right conditions, or given the right signals, stem cells can give rise (differentiate) to the many different cell types that make up the organism. That is, stem cells have the potential to develop into mature cells that have characteristic shapes and specialized functions, such as heart cells, skin cells, or nerve cells ***(Slack, 2000).***

The stem cells may be classified according to their origin as embryonic stem cells (ESCs), embryonic germ stem cells (EGSCs), and adult stem cells. As the name implies, embryonic stem cells come from embryos that have developed from eggs that have been fertilized in vitro. Embryonic germ cells are similar to embryonic stem cells except they are collected from the fetus later in development. Adult stem cells originate in a mature organism and help maintain and repair the tissues in which they are found. These stem cells are responsible for replacing blood and tissues on a regular basis ***(Kelly, 2007).***

Bone marrow contains three types of stem cells:

1- *Hematopoietic stem cells:* give rise to the three classes of blood cells that are found in the circulation: white blood cells (leukocytes), red blood cells (erythrocytes), and platelets (thrombocytes).

2- *Mesenchymal stem cells*: are found arrayed around the central sinus in the bone marrow. They have the capability to differentiate into osteoblasts, chondrocytes, myocytes, and many other types of cells. They also function as "gatekeeper" cells of the bone marrow.

3- *Endothelial stem cell*s ***(Rubin & Strayer, 2007).***

Stem cells have three very important properties that make them unique and useful: they can self-renew, they are pluripotent, and they can remain undifferentiated. Stem cells selfrenew when they divide to make more stem cells. Stem cells are also undifferentiated. That is, they do not have any characteristics of a specific cell type, such as the ability to “beat”,

as heart muscle cells do, or to transmit a nerve impulse, as nerve cells do. However, when the body is damaged by disease or injury, stem cells serve as a sort of reserve "pool" of repair cells. They can be called into service by distress signals transmitted by damaged tissues. The signals cause the unspecialized stem cells to begin to differentiate–that is, they assume characteristics of a specific tissue ***(Battey & Cole, 2006).***

Stem cell therapy for osteonecrosis of the femoral head (ONFH) avoids the progression of the disease to the stage of the subchondral fracture (stage III) and reduces the need for THR. The mechanisms involved might include improved osteogenesis and angiogenesis. This new therapeutic approach should modify the treatment of early-stage ONFH ***(Gangji, Toungouz et al., 2005).***