

## Stem cell therapy for patient with osteoarthritis detected by Radiology imaging Case report and literature review

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**Abstract :** *Osteoarthritis is a joint inflammation disorder , which result from cartilage degeneration most common caused by aging , overweight , hereditary or traumatic injuries. Researcher reported a case of osteoarthritis which had acute onset on kneejoint , detecting by radiography imaging and confirming by Ultrasonography and Magnetic resonance imaging techniques. The pathology was successfully treated by new method of stem cell therapy, a method which is newer and very few reported found in similar cases in literature. This tool used as an identification for treatment osteoarthritis problems. Therefore the author highlight this in recent work , as addresses key challenges of stem cell-based therapies for treatment OA and to provide example of innovative ways in which stem cells can aid in the treatment of such diseases .*

**Keywords:** *Osteoarthritis, Radiology imaging , stem cell therapy*

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### I. Introduction

Osteoarthritis (OA) has evolved to be considered a disease of the whole joints , therefore it is important to assess all intraarticular structures including degenerative changes in the bones, cartilage, menisci, ligaments, and synovial tissue, to further understand disease pathogenesis and progression ideally. Radiological imaging modalities would enable sensitive and specific depiction of all components of the joint with or without utilizing intravenous contrast. However, in some tissues, additional supplemental imaging modalities may be necessary to enhance depiction, especially in the synovial and joints assessment of OA . ( 1)

The traditional diagnosis made using imaging with radiographs that demonstrate joint space width (JSW) and osteophyte. Recently additional advanced modalities were used such as magnetic resonance imaging (MRI), ultrasound (US), and Computed tomography scan (CT), (2,3) , these modalities have been used to enhanced OA diagnosis , and management through improvements in early identification of OA marks, and clinical decision. This will help in the understanding of disease progression and treatment options. One of these options is knee cartilage regeneration repair by Stem cell therapy which is a new treatment procedure . This procedure has the potential to decrease inflammation that progression of the arthritic damage, repair joint cartilage, and delay or avoid knee replacement surgery. (4,5)

It is possible that the articular cartilages damage , and the osteophytes formation resulting in the increase local joints pain . Moreover , circulating bacteria can access inflamed joints more easily due to synovial inflammation . Many cases reports found in literature described the osteoarthritis as the first presentation of a multiple myeloma . (6,7 ) In recent case report combined with literature review discussion , the author described osteoarthritis pathologies caused by different agents such as hereditary genetic factors , aging degenerations , acquired infection , overweight which add additional pressure to the hips and knees joints moreover repetitive movement or injuries to joints such as fractures and ligament tears . All these factors can lead to osteoarthritis disease ( OA).

### II. Case report

A 45 years old woman presented before 6 months with a history of severe progressive pain on general peripheral joint particularly of the right knee that had begun after painful upon standing from a sitting position. Her past medical history revealed a family history , the patient was complaining of knee joint pain for two years ago, and treated conservatively with corticosteroids and anti-inflammatory medications in an attempt to reduce the inflammatory response . Despite treatment , the pain of both knees particularly, the right knee increased.

At presentation, the patient was not able to stand on her right leg. Body temperature was normal (37.2) C°. But the right knee was swollen and warm, with no redness or discoloration seen. Palpation was painful at the lateral joint space and when flexion or extension of the knee. The complete blood count examination showed

slightly elevation of C - reactive protein (CRP) level and leucocytes . The ESR level also elevated(60)mm/hrand Rheumatoid factor is negative . Radiographic examination were done for both knees , the plain X-ray for both knees revealed osteoarthritis of the medial compartment with moderate to severe narrowing joint space, right knee showed sever bonyerosion changes particularly at right side. Formation of osteophyte were seen .The patient referred for further radiologyexaminations to confirming the diagnosis , such as ultrasoundto the peripheral wrist and hand , in addition to DopplerUS for knees . MRI scanning imaging also requested to assessing cartilages and ligamentfor booth knees .The differential diagnosis of MRI examinations revealedpresent of cartilage damage near the joint surface which was best visualized on PD-weighted images andT1-weight SE images for both knees. Synovitis and common inflammatory changes also seen which well demonstrated on T2-weight images. Osteophytes, and abnormal detection of superficial components of the menisci degeneration in the both knees were alsovisualized , which was more severe in the right knee more than the left knee joint . Ultrasound for hand and wrist detected normal metatarsophalangeal joints and no more osteophytes in hand joints was performed . The final report diagnosis as both knees Osteoarthritis ( OA).

The patient was advised for total knees joint replacement as radical treatment ,first for right knee and after while (requested later) to the left knee or stem cell-based therapy as alternative . In fact , the patient firstly was too worry about this type of treatment , and the patient thought that ,she is too young for total knees replacement and she will select the other choice, which she is also worry about . Because stem cell therapy is a new technique and no more reports in literature were found about the response effectiveness. The orthopedist physician thought that , the patient is too young and can response effectively to the therapy . The patient finally decided to do the operation.Andsuccessfully the operation was done, the patient responded effectively to the treatment and completely stopped all medication and painkillers . Now the patient is very well , and do ther daily activates normally without any difficulties. Nowadays the patient returned back to check her status routinely , and after follow up examinations , the patient was fully recovered by the aid of stem cells therapy intervention.

### III. Discussion and Results

#### 3.1 Radiological studiesresults;

Osteoarthritis (OA) is predominantly a clinical diagnosis for the case under study, and radiology imaging , may provide confirmation and aid with differential diagnosis, these focusing on their utility as tissue specific diagnostic tools.The application of the radiological imaging modalities , are widely available including plain radiograph , ultrasound ( US) ,magnetic resonance imaging (MRI) andcomputed tomography imaging ( CT).All these modalities can be used in clinical practice according to the conditions. (8). The main findings of the various radiologicalallmodalities requested for the case under study were summarized as follows: Bony changes in the early stages of OA disease , have been assessed traditionally using plain radiography . It can give diagnosis of such developments such as osteophytes formation , subchondral bone erosion and joint space narrowing (JSN ).In case under study, plainRadiographswere done for both knees and both wrist joints to evaluate osteophyte formation and joint space narrowing (JSN) and grading . The results obtained was present of osteophyte formation , bone erosion and joint space narrowing in both knees ( fig 1) , theboth wrist joints are normal .

The diagnosis of knee OA can be made in the presence of specific clinical and examination features even if a radiograph appears normal , and it is important to realize that additional further studies is needed to add another values for different imaging modality . (9,10)

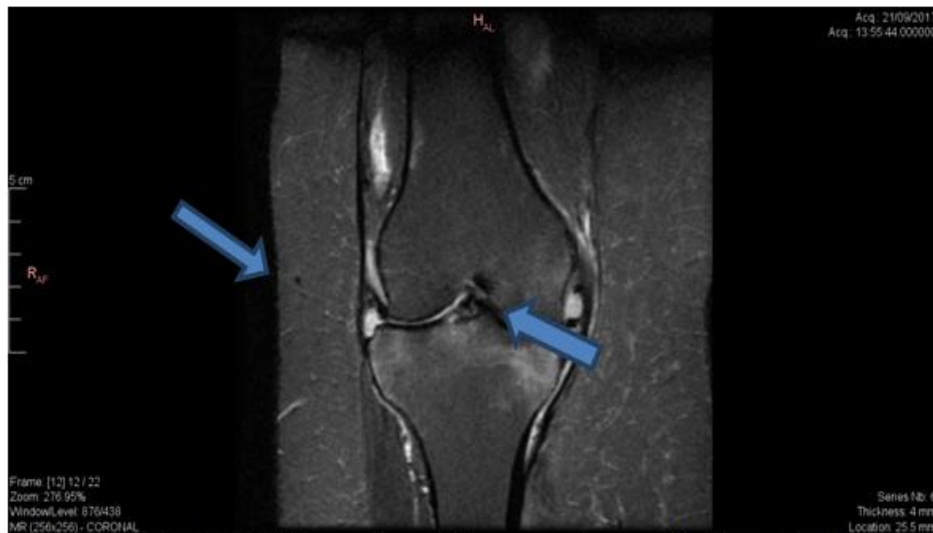


(Fig1 ) Osteoarthritis demonstrated by X-ray knee joint ,showing bone erosion and narrowing joint space particularly on right side (blue arrow)

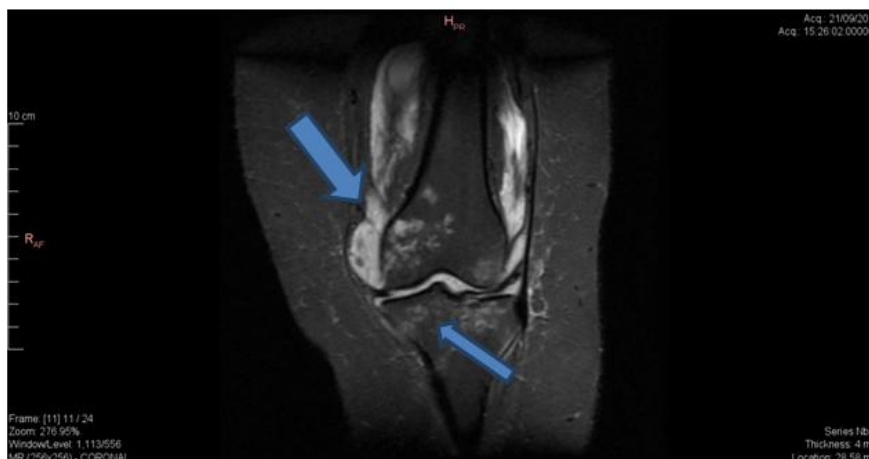
Ultrasound studies can be used to confirm the diagnosis depending on its acoustic window, where US technology currently, acquires images with wide fields of view using high resolution probes which operating at frequencies of up to 20 MHz. The technology offers many advantages involved in OA, including acquisition image in realtime and lack of ionizing radiation, furthermore it is less in cost, available and can be used without contrast enhancement to visualize various tissues. The disadvantages summarize on operator dependent, where it requires a skilled operator. (11, 12, 13). The pathological findings summarize in its ability to assess most peripheral OA joints and knee pathologies changes, such as detection of synovial hypertrophy as abnormal hypoechoic and vascularity problems using Doppler techniques. (14, 15). It can also visualize inflammation edema near the joint surface, cartilage osteophytes, superficial meniscal extrusion and cyst in a swollen knee as example. It can be very helpful in the differential diagnosis of painful joints, this detection would add weight to Ultrasound in a diagnosis of OA, but cannot assess subchondral bone lesions and the findings may vary depending on joint positioning. (16, 17). In case under study, ultrasound for hand and wrist reveal normal texture, just minimal synovitis seen with Doppler technique which can be neglected.

When there is a rapid increase in symptoms such as vascular necrosis, additional diagnosis were recommended such as MRI, where it is better in visualization bone necrosis and can give more details. Also MRI can providing information's about bone marrow conditions, assessment of cartilage bone lesions, focal cartilage defects, imaging of the menisci, detection of changes that indicate layers or defects of articular cartilage with increased signal intensity and damage to ligaments such as the anterior and posterior cruciate ligaments. The advantage of MRI over US in OA diagnoses summarize on its ability to detect joints without being obscured by bone and visualization synovium clearly in deep location. The demonstrated techniques used is spin echo (SE) sequences and gradient echo sequences to obtained PD weighted images, T2 weighted images with hyper intensity detection and Fat suppression images. T1 post contrast images as hypo intense detection used to diagnosis lesions and highlight different tissue types. (18, 19)

The MRI finding for the both knees in case under study, reveal, a severe degeneration changes to ligament surfaces and completely damage to cartilages particularly for right knee joint with common inflammatory changes surrounded both knees. Moreover bone erosion and narrowing joint space. Total replacement for right knee joint as radical treatment was recommended or Stem cell therapy as alternative treatment. (fig 2. 3)



**(Fig 2)** Coronal view MRI (Stir) image shows fat suppressed surround left knee joint (blue arrows)



(Fig 3) Coronal view, Fat Suppressed MRI image shows inflammatory changes surrounded right knee joint (blue arrows)

### 3.2 Stem cells therapy:

The current case report showed the diagnostic challenge of osteoarthritis of the peripheral joints especially the knee joint, used radiology investigations. The patient was treated previously with corticosteroids without clinical improvement noticed. And recommended for Stem cell therapy. There is a lack of effective repair to the widespread degeneration of the joint associated with osteoarthritis (OA) or dysfunction following cartilage injuries which resulting in progressive tissue loss. The definitive treatment for endstage OA, remains the total joint replacement with artificial components. But the limited lifespan of these treatment may be unable to meet the growing demand from active younger patients. This will providing an opportunity for the development of new therapeutic approaches such as Stem cells therapy. (20) Comparing to joint replacement, stem cells may be able to provide an abundant cell source and have an advantage of preventing the damage associated with the invasive of implantation strategies. In this way, significant progress has been made in understanding the challenges to successful stem cell therapy. These challenges such as the effects of age or disease properties, altered of stem cell function due to environment inflammation, and phenotypic instability in vivo. This lead to novel designs to enhance the mechanical properties of engineered cartilage tissue and have also improved the integration of newly formed tissue within the joint. (21) Additionally to that, there is continued development of tissue engineering strategies which has combine stem cells with other various factors such as growth factors and bioreactors. Few previous reports describe the difficulties associated with focal cartilage defects, and some approaches fall into the cartilage tissue engineering paradigm of transplanting newly formed cartilage to resurface the joint. While others seek to expand how stem cells can be used to combat OA by enhancing the body's endogenous regenerative capacity. (22,23)

### 3.3 Conclusion

In recent report, author highlight current work that is applied challenges of stem cell therapy for osteoarthritis disease in innovative ways. However, in order for stem cell-based therapies to emerge as viable alternatives, challenges associated with using stem cells to treat osteoarthritis patients, must be identified and addressed.

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