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Case Report

Concentrated bone marrow aspirate and application for the treatment of osteochondral lesion and outcome

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ABSTRACT

As osteochondral defects heal spontaneously or as a result of marrow stimulation, a bone marrow clot develops inside the cartilage defect. In the clot-filled defect, MSCs from the subchondral bone move in, develop into chondrocytes and osteoblasts, and eventually create a repair tissue. It is believed that applying a bone marrow aspirate (BMA) to marrow stimulation will improve cartilage repair since it may serve as a source of growth factors that promote both chondrogenesis and cartilage repair. Furthermore, the BMA clot offers a three-dimensional environment that may help chondrogenesis even more while safeguarding the subchondral bone from structural changes. In this treatment, bone marrow aspirate concentrated cells (BMAC), hyaluronic acid, and fibrin gel are applied after microfracture. The surgical procedure involved debridement of the lesion, microfracture, and application of concentrated BMAC with HA and fibrin gel.

1. Introduction

The recent increase in chondral injury diagnoses isn't due to a shift in the disease's normal course, but rather to advancements in our knowledge of its pathology and diagnostic technology.[1] Osteochondral grafting can restore the missing hyaline cartilage but is constrained by the size, number, and morbidity of the donor site. For the pathology of the knee, bone marrow aspirate concentrate (BMAC) has become a cutting-edge therapy. BMAC is a source of growth factors, which are regarded to be significant because of their anabolic and anti-inflammatory properties, despite having a small number of stem cells. Multipotent mesenchymal stem cells (MSC) and growth factors found in bone marrow concentrate cells (BMAC) have attracted interest and have shown to be as least as effective as existing methods.[2,3]

Gels and scaffolds made of collagen have undergone testing to improve transplant fixation. Hyaluronic acid and fibrin gel together could serve as a framework for cartilage repair.[4]

2. Case History

Male, age 18, complaining of left knee pain when walking for the past three months. The left knee has previously experienced injuries from being hit by a bike two years ago.

On examination, there were no external injuries or swelling, just an antalgic gait. Tenderness was present on the left femur lateral condyle with no crepitus on movement.

ROM at the knee joint: 90–130 degrees of painful flexion with no restriction; no extension lags. No difference in limb length. No neurovascular deficit.

2.1. Preoperative scans

2.2. Surgical technique

2.2.1. Aspiration of the bone marrow

Write down the patient's ASIS. About 30 cc of bone marrow is aspirated from the iliac crest using an aspiration needle

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Fig. 1: X-ray showing an antero-posterior and lateral view of left knee joint

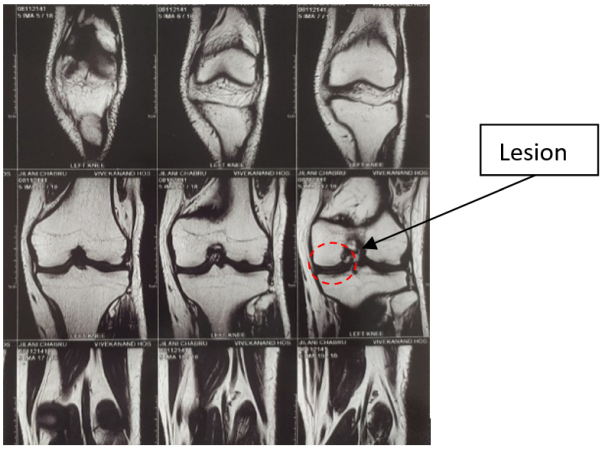

Fig. 2: Coronal section of MRI scan showing the defect

and syringes filled with anticoagulant solution (Citrate Dextrose). (Figures 3 and 4).

The aspirate of bone marrow was then centrifuged twice.

To obtain BMAC, the second cycle was run for 5 minutes at 3600 rpm after the first cycle's 6 minutes at 3500 rpm.

2.3. The process of making the BMAC, HA, and fibrin gel mixture

Two syringes are attached to a mixing catheter for application. 0.8 ml of fibrinogen and 0.2 ml of hyaluronic acid are combined in one syringe. 0.8 ml of BMC and 0.2 ml of thrombin are present in the second syringe. (Figure 5)

Fig. 3: Showing aspirated bone morrow

Fig. 4: Showing the aspiration of bone marrow

Fig. 5: Showing Y connector syringe with the mixture

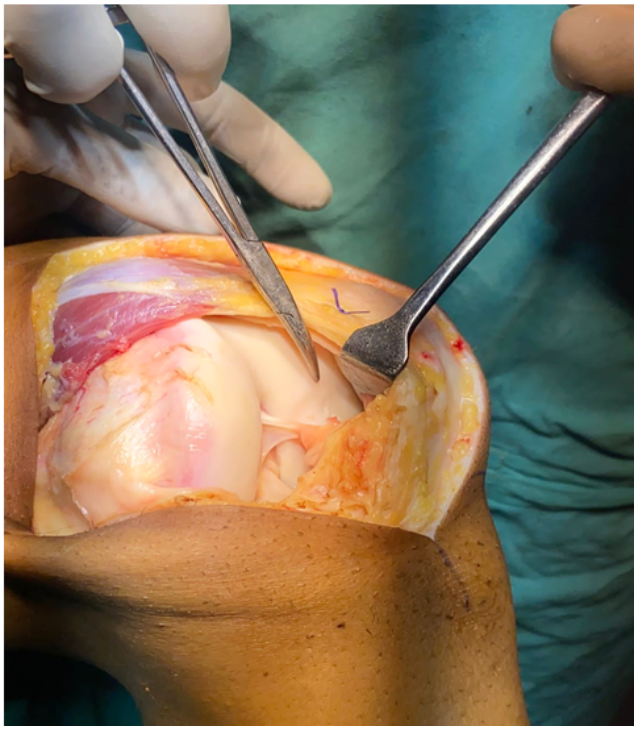

Fig. 6: Showing identified lesion

2.4. A combination has a 1:1 ratio of fibrinogen to thrombin

The knee was accessed via a midline incision and a sub-vastus approach. Pre-operative imaging helped with the evaluation of the knee joint and the identification of the chondral lesions. Two lesions were determined to be suitable for repair. The lesions were removed with curettes, and a hole was drilled into the defect. Care was taken to preserve a stable knee of good cartilage along the lesion's periphery. Holes have been dug to a depth of 3 mm at 3 mm intervals. (Figure 7). A clean wash was administered.

2.5. Mixture application

The BMAC, HA, and fibrin gel combination is applied evenly and gently across the lesion (s). Within five minutes, the graft becomes hard. The knee is then repeatedly moved through its range of motion to anatomically shape the graft and verify its stability (Figure 8)

2.6. Rehabilitation phases

2.6.1. Phase 1

1. Objectives
   (a) Reduce pain and effusion;
   (b) Shield the transplant from bearing loads and shearing pressures.
   (c) Muscle atrophy,
   (d) Active full extension, and knee healing over time.

Fig. 7: Micro-fractures done into the lesion

Fig. 8: Lesions filled with BMAC mixture

2. The criterion for achievements
   (a) Knee flexion of greater than 120 degrees is achieved.
   (b) Complete active knee extension is also a requirement.
   (c) Little to no pain and swelling - attained
   (d) Achieved pain-free weight bearing
   (e) Quadriceps muscle recruitment was adequate and successful.

2.6.2. *Phase 2*

1. Transition and restoration of gait
   (a) Attained a normal gait
   (b) Whole range of motion recovery (full extension, flexion > 135°) attained
   (c) Achieved adequate muscle tone and neuromuscular control
   (d) No discomfort or puffiness. – Attained

Follow up status of the patient after 3 months.

1. No new complaints,
2. Examination reveals normal gait,
3. The suture site is intact and healthy.
4. Knee joint range of motion: painless full-range movements
5. There is no neuromuscular deficit and adequate muscle tone.

2.7. *Post op after 3 months*

Fig. 9: Knee flexion in prone

Fig. 10: Knee flexion in supine

Fig. 11: Knee extension

3. Discussion

An orthopedic surgeon finds osteochondral lesions in young children challenging. However, the outcomes of other techniques such as autologous chondrocyte transplantation, mosaicplasty, and platelet concentrated grafts are not

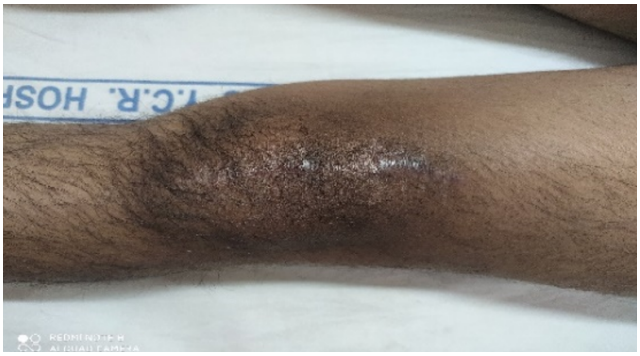

Fig. 12: Operative scar site

promising. This straightforward method is safe and effective because it doesn't cause any new cartilage defects. Moreover, it is less expensive than chondrocyte cultivation. Fibrocartilage regenerates after bone marrow stimulation, which is how BMAC works. However, in order to use the BMAC and compare it to ACT, high-level systemic investigations are required.

4. Conclusion

In this case report conclude that Bone marrow aspiration concentrate has potential to enhance cartilage repair and compare to other methods has its advantage over them. BMAC application are effective in improving pain and functional outcome in patients of osteochondral lesion. This is case report and a larger randomised trail needed to make definitive conclusions.

5. Source of Funding

None.

6. Conflict of Interest

None.

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