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Platelet-Rich Plasma in Treatment of Knee Osteoarthritis

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ABSTRACT

Background: Osteoarthritis (OA) is one of the crucial musculoskeletal disorders that are characterized by the imbalanced homeostasis and destruction of the articular cartilage.

Objective: This study aimed to evaluate the effect of platelet-rich plasma (PRP) in treatment of knee osteoarthritis.

Patients and Methods: This interventional study was carried out on 20 patients who were suffering from mild to moderate primary osteoarthritis of knee joint during the period from May 2012 to March 2013. They were diagnosed clinically, and by plain x- ray and Doppler musculoskeletal ultrasound.

Results: There were 5 patients (25%) experienced slight pain at the site of injection lasted for one week and only one patient (5%) experienced marked pain. Two patients (10%) had skin discoloration in the form of bruising. No reported cases suffered from infection nor allergic reaction.

Conclusion: we concluded that PRP intra-articular injection is an effective method for treatment of knee OA. It is a safe & economic alternative method of treatment. Maximal improvement is obtained in patients with young age and short disease duration.

Keywords: Platelet-rich plasma**,** Osteoarthritis, Knee.

INTRODUCTION

Osteoarthritis (OA) is one of the crucial musculoskeletal disorders that are characterized by the imbalanced homeostasis and destruction of the articular cartilage, in which pro-inflammatory cytokines are important catabolic regulators during OA cascade [1].

Knee osteoarthritis is a major public health problem, and in elderly people causes pain and disability in one third of all affected patients [2].

Platelet-rich plasma (PRP) is a natural concentrate of autologous growth factors from the blood. The method is simple, low cost, and minimally invasive. Currently, a wide range of experiments is taking place in different fields of medicine in order to test the potential of enhancing tissue regeneration [3]. Platelet rich plasma is a blood product that allows in a simple, low cost and minimally invasive way to obtain a concentration of many growth factors and experimented in different fields of medicine in order to test its potential to enhance tissue regeneration [4,5] **.**

The application of PRP to treat OA of the knee can be considered a relatively new therapeutic indication that focuses undoubtly on the most current research [6]**.**

This study was performed to evaluate the effectiveness of local injection of autologous platelet-rich plasma in reducing pain and improving function in patients with mild to moderate knee osteoarthritis.

PATIENTS AND METHODS

This interventional study was conducted in Orthopedic Department, Zagazig University Hospitals during the period from May 2012 to march 2013. Twenty patients were enrolled and treated with PRP intra-articular knee injections. They were 14 (70%) females and 6 (30%) males. Their ages ranged from 40-70 years with a mean of 50.4 ± 8.7 years.

Inclusion criteria for patients selection:

History of chronic (at least 4 months) pain or swelling of the knee and imaging findings (Radiograph or Ultrasound) of mild to moderate degenerative changes in the joint. All the patients presented with a chronic degenerative condition (knees presented with a degenerative chondral lesion early osteoarthritis (Kellgren I–III).

Exclusion criteria:

Systemic disorders such as diabetes, rheumatoid arthritis, major axial deviation (varus more than 5 degrees and valgus more than 5 degrees), hematological diseases (coagulopathies), severe cardiovascular diseases, infections, immunosuppression, patients on therapy with anticoagulants–antiaggregants, use of NSAIDs within 5 days before blood donation.

All patients were subjected to the following:

Full medical history including preorganized case history questionnaire, demographic data (sex, age, educational level, occupation, number of children, residence, current marital status and special habits of medical importance) and plain x-ray of the affected knee (Anteroposterior and lateral views). Grading of knee OA was done according to the Kellgren- Lawrence grading system [7]**.** Diagnostic Doppler ultrasonography of the knee joint with comment on synovial thickness, cartilage thickness, regularity of the cartilage margin, effusion and analysis of periarticular areas, e.g., bursitis.

Ethical consent:

The study was approved by The Institutional Review Board (IRB), Faculty of Medicine, Zagazig University. Informed written consent was taken from every patient or their caregivers.

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This work was performed according to the code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis

The collected data were coded, processed and analyzed using the SPSS (Statistical Package for Social Sciences) version 14 for Windows® (IBM SPSS Inc., Chicago, IL, USA). Data were tested for normal distribution using Shapiro Walk test. Qualitative data were represented as frequencies and relative percentages. Chi square test (χ^2) was used to calculate difference between two or more groups of qualitative variables. Quantitative data were expressed as mean ± SD (Standard deviation). Independent samples t-test was used to compare between two independent groups of normally distributed variables (parametric data). P value ≤ 0.05 was considered significant.

RESULTS

Figure (1) showed that female patients were 14 (70%), while males were 6 (30%).

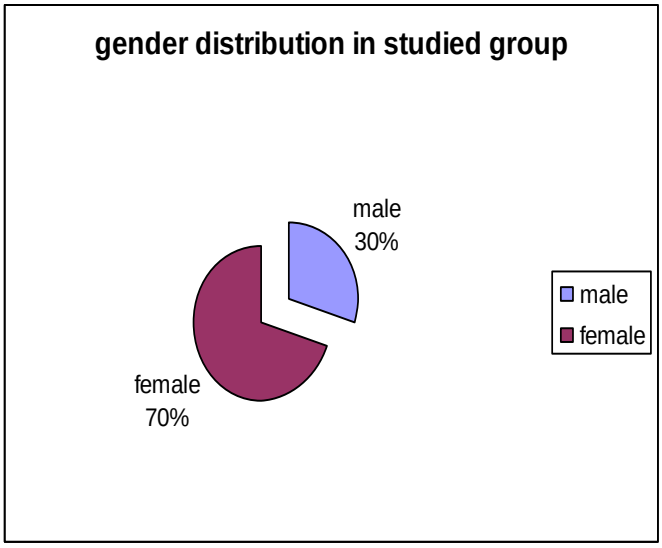

Figure (1): Gender distribution in the studied patients

Table (1) showed that the age of studied group ranged from 40 to 70 years with a mean of 50.4 ± 8.7, Most of the patients were overweight with body mass index ranged from 22-35%, with a mean of 28.4 ± 7.7. Their disease duration ranged from 19-30 months.

Table (1): Sociodemographic data of patients

	Mean ± SD	Range
Age (years)	50.4 ± 8.7	40- 70
BMI (%)	28.4 ± 7.7	22 – 35
Disease duration (months)	24 ± 5	19 -30

BMI: Body mass index

Table (2) showed clinical data obtained by examination of the affected knee joint at base line. Hotness of the knee joint was observed in 2% of patients. Crepitus & tenderness in joint line were found in 65%. While, effusion & backer's cyst were found in 5% of patients. Only 35% of patients had limited range of motion.

Table (2): Clinical data of patients at base line

	No	Percentage (%)
Hotness		
Absent	18	80
present	2	20
Tender joint line		
Absent	7	35
Present	13	65
Crepitus		
Absent	7	35
Present	13	65
Effusion		
Absent	19	95
Present	1	5
Backer cyst		
Absent	19	95
present	1	5
ROM		
Normal	13	65
Limited	7	35

ROM: Range of motion

Assessment of pain and function of affected joints at 1st visit was done by VAS of pain and IKDC score respectively. VAS ranged from 4-7 with mean of 5.9 ± 1.3 and IKDC score ranged from 30-40 with mean of 40.9 ± 10.4. Patients suffered from inactivity stiffness ranged from 15-30 minutes with mean of 18.7 ± 6.5 (Table 3).

Table (3): Assessment of pain& function of affected patients at base line

	Mean ± SD	Range
Inactivity stiffness (min)	18.7± 6.5	15-30
IKDC score	40.9 ± 10.4	30-40
VAS	5.9 ± 1.3	4-7

VAS: visual analogue scale for pain (0-10) cm

IKDC: International knee document committee (0-100)

Table (4) showed high frequency Doppler US examination of the affected knee joints where 7 cases (35%) showed Doppler activity indicating synovitis,10 cases (50%) had partial cartilage thickness affection and 7 cases (35%) had full thickness affection without underlying subchondral change. Concerning regularity

of cartilage margin, 12 cases (60%) showed mild irregularity and 8 cases (40%) showed moderate irregularity.

Table (4): Musculoskeletal Doppler ultrasound of affected joints at base line

	No = 20	**%**
Doppler activity	7	35%
Partial cartilage thickness affection	10	50%
Full thickness cartilage affection without underlying subchondral change	7	35%
Regularity of cartilage margin Mild irregularity Moderate irregularity	 12 8	 60% 40%

Regarding x-ray grading, there were no changes in the number of patients of each grade after 6 PRP injections (Table 5).

Table (5): Effects of PRP injections on x-ray findings

	Base line	**After 6 injections**
Grade 1	6	6
Grade 2	10	10
Grade 3	14	14

In this study, 5 patients (25%) experienced slight pain at the site of injection lasted for one week and only one patient (5%) experienced marked pain. Two patients (10%) had skin discoloration in the form of bruising. No reported cases suffered from infection nor allergic reaction (Table 6).

Table (6): Side effects of PRP injections

	No = 20	**%**
Pain in injected area Slight Marked	 5 1	 25% 5%
Infection	-	0.0
Allergic reaction	-	0.0
Skin discoloration (bruises)	2	10%

DISCUSSION

They were 14 (70%) females and 6 (30%) males. Their ages ranged from 40-70 years with a mean of 50.4 ± 8.7 years. Twenty patients were enrolled and treated with PRP intra-articular knee injections. They were prospectively evaluated at baseline and after 6 months follow-up. A statistically significant improvement, was observed regarding most of the clinical aspects, such as, tender joint line, crepitus, and range of motion. There was, also, improvement in number of patients having hotness, effusion and backer´s cyst, but didn´t reach statistically significant level.

In this study, there were highly statistically significant improvement in the patient´s perception of pain, knee function and quality of life, represented by the duration of inactivity stiffness and VAS & IKDC scores.

As regards x-ray findings, our study showed no changes between baseline x- ray films and x-ray after 6 PRP injections.

Regarding musculoskeletal Doppler ultrasound findings, there were no significant differences in both cartilage thickness, and regularity of cartilage margin after 6 PRP injections, While, US showed a highly significant improvement in synovial thickness i.e. decrease synovial membrane hyperplasia, and showed significant improvement in Doppler activity (p=0.04), as 35% of cases showed Doppler activity at baseline, while only 10% of cases showed it after 6 PRP injections.

Our study showed that this method of treatment is very safe as no complications such as infection or fever occurred among study subjects. Only minor adverse events were detected such as mild pain at injected area and skin bruises.

Mitssuyama *et al.* [8] investigated the effects of platelet-rich plasma on proliferation and re-differentiation of cultivated human chondrocytes. Their results showed that PRP promotes human chondrocyte proliferation and cells expanded with 30%. Also, PRP can express chondrocyte phenotype, and can serve as scaffold for autologous chondrocyte implantation that has potential availability for repair of osteoarthritis with chondral defects. Additionally, **Sanchez *et al.*** [9] reported in their results about the effectiveness of intra-articular injections of an autologous plasma preparation rich in growth factors for knee OA treatment in an observational retrospective cohort study on 30 patients suggesting the safety and usefulness of this treatment approach. Furthermore, **Wang *et al.*** [10] conducted a study on 261 patients treated with 3 injections of PRP every 15 days and were followed for 6 months. They reported improvement in all outcome measures relative to baseline.

CONCLUSION

The treatment with intra-articular platelet-rich plasma injections has the potential to reduce pain and improve both knee function and quality of life especially in younger patients with chondral degenerative lesions or early osteoarthritis. The clinical results of this research suggest that this type of treatment is safe, simple, economic and minimally invasive procedure and it may be clinically applied in patients with knee degeneration to avoid, or at least delay, the need for more invasive surgical procedures.

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Author contribution: Authors contributed equally in the study.

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