

Original Research Article

Clinical efficacy and inflammatory factors in knee osteoarthritis with glucosamine hydrochloride plus meloxicam

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Abstract

Purpose: To evaluate the efficacy and change in serum levels of inflammatory factors in knee osteoarthritis (KOA) treated with glucosamine hydrochloride plus meloxicam.

Methods: In total, 114 patients with KOA who received glucosamine hydrochloride plus meloxicam treatment were included in the study and equally distributed to a control group and a study group. The control group received glucosamine hydrochloride, and the study group received a similar treatment but, received in additional, meloxicam. Clinical efficacy, numerical rating scale (NRS) score, quality of life (QoL) score, index of severity for osteoarthritis (ISOA) score, and related inflammatory factors were assessed and compared.

Results: The study group outperformed the control group in terms of clinical efficacy. Significantly lower NRS scores were obtained in the study group at T2, T3, and T4 than those of the control group ($p < 0.001$). Before treatment, the two groups presented similar ISOA score, QoL score, and interleukin (IL)-6 and tumor necrosis factor- α (TNF- α) levels. After treatment, ISOA score, and IL-6 and TNF- α levels declined in all patients, with lower results obtained in the study group. All patients obtained significantly higher QoL score after treatment, with higher outcomes observed in the study group.

Conclusion: The combination of glucosamine hydrochloride and meloxicam effectively improves the joint function of patients with KOA and relieves symptoms such as joint swelling and pain. Thus, the treatment strategy has great promise.

Keywords: Glucosamine, Meloxicam, Knee osteoarthritis, Serum inflammatory Factors

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INTRODUCTION

Knee osteoarthritis (KOA) is characterized by bone hyperplasia and knee cartilage degeneration, to which the elderly population is more susceptible. With the continuous increase of the aging population, the prevalence of KOA has shown an increasing trend year by year. The

prevalence rate in China has reached 8.2 %, with pronounced regional characteristics, mainly in northwestern and southwestern China [1]. The primary cause for KOA remains unidentified and is speculated to be associated with factors such as age, obesity, inflammation, and trauma [2]. Clinical treatment of the disease is to relieve pain, delay disease progression, restore joint

function, and enhance the quality of life [3]. Traditionally used drugs are criticized for a short maintenance time, poor efficacy, and numerous side effects. Glucosamine hydrochloride is a natural amino monosaccharide with anti-inflammatory, antipyretic, and analgesic effects, which can effectively delay the progression of KOA, improve joint mobility, and mitigate joint pain [4].

Meloxicam is a class of steroidal anti-inflammatory drugs with anti-inflammatory, anti-rheumatic, anti-coagulant, and hemostatic effects [5]. As a used drug in KOA, glucosamine hydrochloride features a wide range of clinical applications with well recognized by patients. However, the efficacy of the single-use of glucosamine hydrochloride remains much to be desired [6]. Therefore, the present study was to examine the efficiency of glucosamine hydrochloride combined with meloxicam in treating KOA and its effect on serum inflammatory factors.

METHODS

General profile of patients

Totally 114 patients with KOA enrolled in our hospital between September 2019 and September 2020 were identified as study subjects and equally distributed to a control group and a study group. The protocol was ethically approved by the Ethics Committee of Xi'an Medical College (approval no. CDS2018-23/34). The Declaration of Helsinki guidelines for human studies [7] were followed in this study.

Inclusion criteria

a) Patients who were diagnosed with KOA; b) Patients without recent associated clinical treatment; c) Patients with complete clinical data; d) Patients who understood the study process and signed the informed consent form.

Exclusion criteria

a) Patients with gouty arthritis, rheumatoid arthritis, or rheumatoid arthritis; b) Patients who were pregnant or breastfeeding; c) Patients with heart, liver, and kidney dysfunction; d) Patients with concomitant mental and other cognitive disorders.

Study design and treatments

All patients received routine clinical treatment, including exercise therapy, physical therapy, and motion-assisted therapy. The control group was

given oral administration of glucosamine hydrochloride (Beijing KangBide Pharmaceutical Co., Ltd. National Medicine License: H20070173 Specifications: 0.24 g* 180 s), 2 tablets/time, 3 times /d, 30 min after meals. The study group was treated with meloxicam (Manufacturer: Sichuan Pharmaceutical Co., Ltd. National medicine approval no. H20031203; Specification: 7.5 mg* 8 s) 1 tablet/time, 1 time/d, 15 min after breakfast, and glucosamine hydrochloride. The administration of glucosamine hydrochloride was the same as the control group. All patients received 3 months of treatment.

Assessment of indicators

Clinical efficacy

Total efficacy = (cured + markedly effective + effective)/Total × 100%. The treatment efficacy was considered cured if all clinical symptoms disappeared and patients had normal joint functions. The efficacy was considered markedly effective if the pain was significantly relieved, and only recurred in fatigue. The efficacy was considered effective if the pain was relieved and patients had mildly limited joint mobility. The efficacy was considered ineffective if no significant improvement was observed in the clinical symptoms and joint functions.

NRS score

The numerical rating scale (NRS) was employed to assess the joint pain at different time points [12], namely, before treatment, 10d after treatment, 1 after month treatment, and 3 months after treatment, which were set as T1, T2, T3, and T4, respectively. The total score of the scale was 10 points. The score is proportional to the severity of the pain.

ISOA score

The ISOA was adopted to evaluate the severity of knee joints of patients before and after treatment, with a full score of 24 points. The score is proportional to the severity of the pain.

Inflammatory factors

Fasting venous blood (3 mL) was obtained from all patients before and after treatment and centrifuged to collect the supernatant. The serum levels of interleukin-6 (IL-6) and tumor necrosis factor- α (TNF- α) in the samples were determined using the ELISA. The Elisa kits were provided by *Elabscience* (cat no. E-EL-H0102c for IL-6 Elisa kit and E-EL-H0109c for TNF- α).

QoL score

Patients' quality of life before and after treatment was evaluated using the Quality-of-Life (QoL) Assessment Form for KOA Patients prepared by our department. The scale has a total score of 20 points. The score is proportional to the quality of life.

Incidence of adverse reactions

The incidence of clinical adverse reactions of all patients during treatment was recorded, including gastrointestinal reaction, palpitation, and abnormal liver function.

Statistics analysis

Data management and analysis were conducted using the SPSS 22.0, and GraphPad Prism 7.0 was used to plot the graphics. Enumeration data are expressed as mean \pm standard deviation (mean \pm SD) and processed using the t-test. Qualitative data are expressed as (n, %) and

processed by the χ^2 test. Differences are considered significant at $p < 0.05$.

RESULTS**Patient profile**

The two groups presented comparable clinical profiles ($p > 0.05$). See Table 1.

Clinical efficacy

The study group outperformed the control group in clinical efficacy ($p < 0.05$).

NRS score

At T1, the two groups showed similar NRS scores ($P > 0.05$). Lower NRS scores were obtained in the study group at T2, T3, and T4 than those of the control group ($p < 0.05$). See Figure 1.

Table 1: Comparison of patient profile

Variable	Control group (n=57)	Study group (n=57)	χ^2/t	P-value
Gender (n, %)			0.141	0.707
<i>Male</i>	30 (52.63%)	32 (56.14%)		
<i>Female</i>	27 (47.37%)	25 (43.86%)		
Age (year)	62.46 \pm 2.54	62.42 \pm 2.58	0.083	0.934
BMI (kg/m ²)	22.15 \pm 1.36	22.18 \pm 1.25	0.123	0.903
Duration (month)	43.29 \pm 14.22	43.26 \pm 14.25	0.011	0.991
Position (n, %)				
<i>Left Side</i>	20 (35.09%)	19 (33.33%)	0.039	0.843
<i>Right Side</i>	28 (49.12%)	26 (45.61%)	0.141	0.708
<i>Both Sides</i>	9 (15.79%)	12 (21.05%)	0.525	0.469
X-ray classification (n, %)				
<i>Level I</i>	13 (22.81%)	16 (28.07%)	0.416	0.519
<i>Level II</i>	30 (52.63%)	32 (56.14%)	0.141	0.707
<i>Level III</i>	14 (24.56%)	9 (15.79%)	1.362	0.243
Literacy level (n, %)				
<i>University</i>	7 (12.28%)	6 (10.53%)	0.087	0.768
<i>Middle School</i>	34 (59.65%)	38 (66.67%)	0.603	0.437
<i>Primary School</i>	16 (28.07%)	13 (22.81%)	0.416	0.519
Residential area (n, %)			0.576	0.448
Urban Area	22 (38.60%)	26 (45.61%)		
Rural Area	35 (61.40%)	31 (54.39%)		

Table 2: Comparison of the clinical efficacy of the two groups (n, %)

Group	Cure	Special effect	Valid	Invalid	Total effectiveness
Control (n=57)	3 (5.26)	27 (47.37)	17 (29.82)	10 (17.54)	82.46% (47/57)
Study (n=57)	9 (15.79)	34 (59.65)	12 (21.05)	2 (3.51)	96.49% (55/57)
χ^2					5.961
P-value					0.015

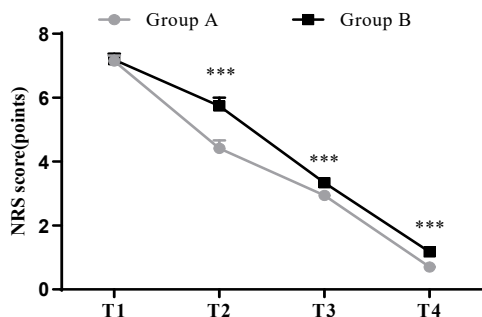


Figure 1: Comparison of NRS scores at different times (***) indicates $p < 0.001$

ISOA scores

Before treatment, similar ISOA scores were obtained in the two groups ($p > 0.05$). The post-treatment ISOA scores were significantly declined in the two groups, with lower results obtained in the study group ($p < 0.05$).

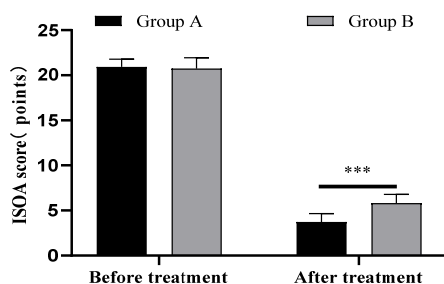


Figure 2: Comparison of the ISOA scores of the two groups (***) indicates $p < 0.001$

Levels of IL-6 and TNF- α

Before treatment, the levels of IL-6 and TNF- α were not significantly different between the two groups ($P > 0.05$). After treatment, the two

Table 3: Comparison of the levels of IL-6 and TNF- α in the two groups mean \pm SD, pg/mL

Variable	IL-6		TNF- α	
	Before treatment	After treatment	Before treatment	After treatment
Control (n=57)	205.89 \pm 25.17	131.23 \pm 19.26	59.85 \pm 9.32	32.21 \pm 5.28
Study (n=57)	206.35 \pm 24.36	87.83 \pm 17.52	60.14 \pm 9.83	23.47 \pm 5.42
t	0.099	12.585	0.162	8.721
P-value	0.921	0.000	0.872	0.000

Table 4: Comparison of the adverse effects of the two groups

Group	Gastrointestinal reaction	Palpitation	Abnormal liver function	Total adverse effects
Control (n=57)	4 (7.02)	3 (5.26)	3 (5.26)	17.54% (10/57)
Study (n=57)	2 (3.51)	1 (1.75)	0 (0.00)	5.26% (3/57)
χ^2				4.254
P-value				0.039

indexes were markedly declined in both groups, in which the study group had a greater decline ($p < 0.05$).

QoL scores

The pre-treatment QoL scores between the two groups were similar ($P > 0.05$). The post-treatment QoL scores were significantly elevated, with a higher result in the study group ($p < 0.05$).

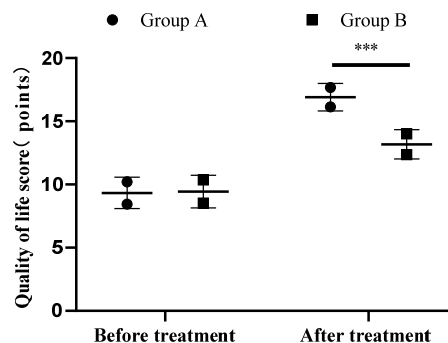


Figure 3: Comparison of the QoL scores of the two groups, (***) indicated $P < 0.001$

Incidence of adverse effects

A lower incidence of adverse reactions was obtained in the study group than in the control group ($p < 0.05$).

DISCUSSION

Prior studies have revealed that KOA is detrimental to the weight-bearing joints of patients such as knees and ankles. With the clinical manifestations of joint stiffness, swelling, pain [8], KOA may progress to joint dysfunction in the later stage, which seriously compromises patients' life quality.

It has been reported that TNF- α promoted inflammation and the apoptosis of chondrocytes, leading to joint destruction [9]. Therefore, the serum level of inflammatory factors is closely associated with the progression of KOA. Normally, the decomposition and metabolism of chondrocytes are in a balanced state and play a key regulatory role in maintaining the integrity of the extracellular matrix. However, KOA disrupts this equilibrium and causes an outpacing of chondrocyte breakdown over synthesis, resulting in articular cartilage lesions [10], so serum inflammatory factors demonstrated great potential as a treatment target in the treatment of KOA.

Glucosamine hydrochloride is a natural amino monosaccharide [11]. After entering the human body, it stimulates the synthesis of mucopolysaccharides and increases the intake of bone calcium, which enhances the nutritional and metabolic status of the patient's cartilage tissue and increases the viscosity of the synovial fluid, thereby ameliorating the joint lubrication function [12]. It has been reported that the drug effectively prevents the progression of degenerative osteoarthropathy, alleviates joint pain, restores joint function, and inhibits the formation of degenerative joint degeneration [13]. Meloxicam, with anti-inflammatory and analgesic effects, selectively inhibits the synthesis of cyclooxygenase-2 (COX-2), suppresses the formation of inflammatory factors prostaglandins, and features potent anti-inflammatory activity [14]. In this study, 57 patients with KOA in our hospital were treated with glucosamine hydrochloride combined with meloxicam. The post-treatment levels of IL-6 and TNF- α were lower than those in the control group ($p < 0.001$).

Luan [15] used meloxicam and glucosamine hydrochloride for patients with gouty arthritis and found significantly reduced IL-6 levels in patients after treatment. It has been confirmed that IL-6 is a leukocyte chemotactic factor and a key transmitter of the inflammatory response that induces the production of acute-phase response protein. TNF- α induces synovial cells to produce inflammatory mediators, stimulates the production of interleukin-1, destroys cartilage tissue, and impairs bone and joint function [16]. The results demonstrated that the drug combination therapy significantly mitigates the inflammatory response of KOA patients, relieves joint swelling, and improves the prognosis. In addition, the present study found that the study group presented lower ISOA scores than those of the control group ($p < 0.001$). The ISOA score is an objective indicator of the severity of joint damage in patients with bone and joint diseases.

With continuous progress, drug combination therapy can further reduce the degree of joint damage in patients, which is conducive to the recovery of joint function.

CONCLUSION

The combination of glucosamine hydrochloride and meloxicam effectively improves the joint function of patients with KOA and relieves symptoms such as joint swelling and pain, which provides a new treatment option for KOA, but the specific mechanism requires further verification.

DECLARATIONS

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Conflict of Interest

No conflict of interest associated with this work.

Contribution of Authors

The authors declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by them.

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