ORIGINAL ARTICLE

Clinical study on ultrasound-guided intra-articular injection of compound betamethasone for the treatment of degenerative knee osteoarthritis

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ABSTRACT

Objective: To explore the clinical efficacy of ultrasound-guided intra-articular injection of compound betamethasone for degenerative knee osteoarthritis.

Methods: A total of 78 patients diagnosed with degenerative knee osteoarthritis at a tertiary A-grade hospital between February 2020 and February 2022 were randomly divided to the injection therapy group and the non-injection therapy group, with 39 patients in each group. The injection therapy group received the ultrasound-guided intra-articular injections of compound betamethasone, while the non-injection therapy group underwent conventional acupuncture treatment. The therapeutic effects, pain levels, osteoarthritis indices, and quality of life between the two groups were compared to evaluate the efficacy of ultrasound-guided intra-articular injection of compound betamethasone for treating degenerative knee osteoarthritis.

Results: The total response rate in the injection therapy group was higher than that in the non-injection therapy group (94.87% vs. 74.36%, $p = .012$). Comparison of Visual Analogue Scale (VAS) scores between the two groups: the pre-treatment VAS scores were 2.34 ± 0.43 in the injection therapy group and 2.37 ± 0.32 in the non-injection therapy group ($p = .727$), showing no statistically significant difference. The post-treatment VAS scores were lower in the injection therapy group than in the non-injection therapy group (1.04 ± 0.21 vs. 1.76 ± 0.34, $p < .001$), indicating a statistically significant difference. Comparison of knee osteoarthritis index (WOMAC) scores between the two groups: the pre-treatment WOMAC scores were 49.88 ± 2.12 in the injection therapy group and 49.76 ± 2.43 in the non-injection therapy group ($p = .816$), showing no statistically significant difference. The post-treatment WOMAC scores were lower in the injection therapy group than that in the non-injection therapy group (22.34 ± 2.32 vs. 34.54 ± 2.36, $p < .001$), indicating a statistically significant difference. The two groups were assessed by use of the SF-36 health survey questionnaire to compare differences in physical functioning, bodily pain, mental health, social functioning, and overall health. The pre-treatment differences were not statistically significant ($p > .05$). While in the post-treatment, the injection therapy group demonstrated significantly higher SF-36 scores across all domains in comparison to the non-injection therapy group ($p < .001$).

Conclusions: Patients with degenerative knee osteoarthritis who undergo ultrasound-guided intra-articular injection of compound betamethasone demonstrate improved therapeutic outcomes, reduced pain levels, enhanced joint function, and elevated quality of life.

Key Words: Ultrasound-guided interventional therapy, Knee osteoarthritis, Compound betamethasone

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1. INTRODUCTION

Knee osteoarthritis is characterized by reactive changes in subchondral bone, the formation of osteophytes along the joint margins, synovial hyperplasia and joint capsule contracture.[1] It is common among middle-aged and elderly individuals, presenting as slowly progressive knee pain, joint swelling, effusion, stiffness and limited mobility. In severe cases, joint deformity may occur.[2] Ultrasound-guided interventional therapy represents a novel treatment approach for degenerative knee osteoarthritis. This technique enables the pre-treatment assessment of knee joints and the surrounding soft tissues, while facilitating the real-time visualization during injection and needle manipulation. It offers the advantages of safety, cost-effectiveness, high dynamic precision, and therapeutic accuracy. This study aims to investigate the clinical efficacy of compound betamethasone administered via ultrasound-guided intra-articular injection. The findings are reported as follows.

2. DATA AND METHODS

A total of 78 patients diagnosed with degenerative knee osteoarthritis at a tertiary A-grade hospital between February 2020 and February 2022 were randomly divided to the injection therapy group and the non-injection therapy group, with 39 patients in each group. The injection therapy group comprised 19 males and 20 females; aged from 48 to 84, with a mean age of 65.54 ± 3.55; the disease course ranged from 2 to 12 months, with a mean of (5.65 ± 1.23) months. The non-injection therapy group comprised 21 males and 18 females; aged from 47 to 83, with a mean age of 66.52 ± 3.87; the disease course ranged from 3 to 11 months, with a mean of 5.35 ± 1.54 months. The comparison of general data between the two groups showed $p > .05$, indicating no statistically significant difference and comparability. Patients and their families were required to sign the informed consent and agreements for this study. This research was reviewed and approved by the hospital's Ethics Committee.

Inclusion criteria were listed as follows: patients who met diagnostic criteria for knee osteoarthritis;[3] with a complete set of baseline data.

Exclusion criteria were listed as follows: patients with mental illness or cognitive impairment; individuals who were unable to compliant with this study.

Treatment methods: The non-injection therapy group received a conventional acupuncture therapy. Patients were administered routine disinfection with acupuncture performed on the following acupoints: Xuehai (SP10), Yanglingquan (GB34), Yinlingquan (SP9) and Zusanli (ST36), once daily for 10 days. The injection therapy group was received ultrasound-guided precision treatment. A high-frequency linear array ultrasound probe was used to scan the upper edge of the patella for effusion and synovial hyperplasia. The lateral recess of the patella was scanned to identify synovial hyperplasia, effusion and chronic aseptic inflammatory hyperplasia along the lateral joint line. The medial aspect of the patella was examined to determine the presence of chronic aseptic inflammatory hyperplasia, synovial hyperplasia, effusion and medial collateral ligament tension along the medial joint line. The patellar ligament and infrapatellar fat pad were also scanned to identify any abnormalities. The targeted treatment were administered on the basis of the examination results. After routine disinfection of the knee joints, the sterile coupling agent was applied with the probe cover inserted over the transducer. Under the guidance of the ultrasound, the operator aspirated accumulated fluid with a syringe, moving the probe to monitor aspiration progress; The scanning was performed to determine the presence of hypertrophic synovium and identify the location of color Doppler signals. At the sites showing blood flow signals in the synovium and the areas of high tension pain associated with chronic aseptic inflammatory reactions along the medial and lateral joint lines, 5 mL of 12% lidocaine injection (Manufacturer: Shanghai Zhaohui Pharmaceutical Co., Ltd.; National Drug Approval No. H31021072), 5 mg of compound betamethasone injection (Manufacturer: Chongqing Huapont Pharmaceutical Co., Ltd.; National Drug Approval No. H20093412) and 4 mL of 0.9% sodium chloride injection were used respectively. The patients were observed for 15 minutes and instructed to reduce physical activities. The follow-up examination was scheduled in one week. If pains persist, the internal heat acupuncture treatment was then performed.

Criteria for evaluating therapeutic effectiveness were listed as follows: (1) marked improvement: Symptoms resolved; (2) improvement: symptoms alleviated; (3) no improvement: symptoms unchanged or worsened. Overall response rate = (Number of marked improvement + Number of improvement) / Total number of cases $\times$ 100%.

Observation indicators: (1) Pain severity. The assessment was performed by use of the Visual Analogue Scale (VAS), where 0 indicates no pain, 1-3 indicates mild pain, 4-6 indicates moderate pain, and 7-10 indicates severe pain. Higher scores indicate greater pain severity; (2) Osteoarthritis index. The assessment was performed by use of Knee Osteoarthritis Index (WOMAC). Total score is 100 points; higher scores indicate more severe osteoarthritis; (3) Quality of Life. The assessment was performed by use of the Health Survey Questionnaire (SF-36) with five dimensions: physical functioning, bodily pain, mental health, social functioning, and overall

health. Each dimension has a maximum score of 100 points; higher scores indicate better quality of life.

Statistical methods: SPSS 23.0 statistical software was used to make an analysis of all data. Measurement data are expressed as mean ± standard deviation ($\bar{x}\pm$s) and analyzed by use of t-tests; categorical data are expressed as n (%) and analyzed by use of chi-square (χ^2) tests. p value < .05 was considered statistically significant.

3. RESULTS

Comparison of treatment efficacy between the two groups: The total effective rate was higher in the injection therapy group than in the non-injection therapy group (p = .012), indicating a statistically significant difference (see Table 1).

Comparison of VAS scores between the two groups: Before treatment, the VAS scores between the two groups showed no statistically significant difference (p > .05). After treatment, the VAS scores in the injection therapy group were significantly lower than those in the non-injection therapy group (p < .001) (see Table 2).

Comparison of WOMAC scores between the two groups: Before treatment, the comparison of WOMAC scores between the two groups showed p > .05, indicating no statistically significant difference. After treatment, the WOMAC scores in the injection therapy group were lower than those in the non-injection therapy group, with p < .001, demonstrating a statistically significant difference (see Table 3).

Comparison of SF-36 scores between the two groups: Before treatment, there were no statistically significant differences in SF-36 scores between the two groups (p > .05). After treatment, the injection therapy group demonstrated significantly higher SF-36 scores than the non-injection therapy group (p < .001) (see Tables 4-8).

Table 1. Comparison of treatment efficacy between the two groups (n [%])

	Injection therapy group (n = 39)	Non-injection therapy group (n = 39)	χ^2	p
Marked improvement	26 (66.67)	21 (53.85)		
Improvement	11 (28.20)	8 (30.51)		
No improvement	2 (5.13)	10 (25.64)		
Total improvement	37 (94.87)	29 (74.36)	6.303	.012

Table 2. Comparison of VAS scores between the two groups ($\bar{x}\pm$s, score)

	Injection therapy group (n = 39)	Non-injection therapy group (n = 39)	t	p
Pre-treatment	2.34±0.43	2.37±0.32	0.349	.727
Post-treatment	1.04±0.21	1.76±0.34	11.252	< .001

Table 3. Comparison of WOMAC scores between the two groups ($\bar{x}\pm$s, score)

	Injection therapy group (n = 39)	Non-injection therapy group (n = 39)	t	p
Pre-treatment	49.88±2.12	49.76±2.43	0.232	.816
Post-treatment	22.34±2.32	34.54±2.36	23.022	< .001

Table 4. Comparison of SF-36 score in physical functioning between the two groups ($\bar{x}\pm$s, score)

	Injection therapy group (n = 39)	Non-injection therapy group (n = 39)	t	p
Pre-treatment	65.43±2.34	65.21±2.46	0.405	.686
Post-treatment	85.43±3.21	73.21±3.54	15.969	< .001

Table 5. Comparison of SF-36 score in bodily pain between the two groups ($\bar{x}\pm$s, score)

	Injection therapy group (n = 39)	Non-injection therapy group (n = 39)	t	p
Pre-treatment	63.43±2.12	62.35±2.68	1.974	.052
Post-treatment	82.43±1.24	72.35±1.56	31.588	< .001

Table 6. Comparison of SF-36 score in mental health between the two groups ($\bar{x}\pm$s, score)

	Injection therapy group (n = 39)	Non-injection therapy group (n = 39)	t	p
Pre-treatment	67.65±2.16	67.79±2.32	0.276	.783
Post-treatment	84.54±2.36	77.65±3.23	10.756	< .001

Table 7. Comparison of SF-36 score in social functioning between the two groups ($\bar{x}\pm$s, score)

	Injection therapy group (n = 39)	Non-injection therapy group (n = 39)	t	p
Pre-treatment	67.62±3.21	67.41±3.54	0.288	.774
Post-treatment	81.43±2.75	74.32±2.56	11.818	< .001

Table 8. Comparison of SF-36 score in overall health between the two groups ($\bar{x}\pm$s, score)

	Injection therapy group (n = 39)	Non-injection therapy group (n = 39)	t	p
Pre-treatment	62.34±3.46	62.36±3.5	0.025	.970
Post-treatment	85.65±1.54	71.27±1.54	41.234	< .001

4. Discussion

Degenerative knee osteoarthritis is a type of hypertrophic arthritis. Because it commonly occurs in the elderly, it is also known as senile arthritis.[3] As the elderly people suffer from gradual deterioration in various bodily functions, the knee joints—a type of crucial weight-bearing joints in the human body—are faced with a higher risk of developing degenerative disease. Degenerative knee osteoarthritis is characterized by knee pain, restricted movement and weakness. In severe cases, it causes limping, significantly impacting patients' daily lives.[4–6]

Clinically, ultrasound-guided precision therapy can be employed to treat degenerative knee osteoarthritis. The use of ultrasound-guided intra-articular injection of compound betamethasone offers great advantages of low cost, non-invasiveness and safety.[7–9] The results of this study indicate that the total effective rate was higher in the injection therapy group than that in the non-injection therapy group, and the osteoarthritis index was lower in the injection therapy group than that in the non-injection therapy group. The analysis indicates that ultrasound-guided intervention technology enables real-time visualization of needle placement and drug injection. It provides clear visualization of the lesion and surrounding structures while simultaneously monitoring aspiration and drug administration in real time. This facilitates more thorough aspiration and enhances the precision and efficiency of diagnosis and treatment. The injection therapy group exhibited lower pain scores and higher quality of life in comparison to the non-injection therapy group. The analysis suggests that ultrasound-guided interventional procedures cause less trauma, thereby avoiding damage to vital organs and tissues. Combined with intradermal heat needle therapy, this approach alleviates patient pain, enhances treatment efficacy, and improves quality of life.[10–12]

5. Conclusions

The targeted treatment with ultrasound-guided intra-articular injection of compound betamethasone in patients with degenerative knee osteoarthritis enhances therapeutic efficacy, alleviates pains, and improves joint function and quality of life.

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Authors contributions

Daxing Guo contributed to the argumentation and manuscript drafting; Ping Li contributed to the supervision of manuscript preparation and technical operation.

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Conflicts of Interest Disclosure

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Informed consent

Obtained.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

DATA SHARING STATEMENT

No additional data are available.

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REFERENCES

[1] Chen R, Ye , Li , et al. Radiographic and Magnetic Resonance Imaging Diagnosis of Knee Osteoarthritis. China Practical Medicine. 2021; 16(17): 110-112.

[2] Zhu Y. Diagnostic Value of Low-Field-Strength Magnetic Resonance Imaging in Degenerative Knee Osteoarthritis. Journal of Imaging Research and Medical Applications. 2021; 5(7): 181-182.

[3] 2007 Chinese Medical Association Orthopaedic Branch Guidelines for the Diagnosis and Treatment of Osteoarthritis. Chinese Journal of Orthopaedics. 2007; 27(10): 793-796.

[4] Wan Q, Deng G, Yang S, et al. Efficacy and safety of floating needle therapy in the treatment of knee osteoarthritis: A protocol for systematic review and meta-analysis. Medicine. 2021; 100(6): 24505. https://doi.org/10.1097/MD.0000000000024505 PMid:33578543 PMCid:PMC7886416

[5] Huang Y. Observation of the Treatment Outcomes of Arthroscopic Lavage and Debridement for Knee Osteoarthritis in the Elderly. China Journal of Medical Database (Medicine). 2021; 21(3): 34-36.

[6] Zhang L. Clinical Diagnostic Effectiveness of Plain Radiographs and MR Imaging in Observing Knee Osteoarthritis. Journal of Imaging Research and Medical Applications. 2021; 5(3): 93-94.

[7] Zhang Y, Zhou L. Clinical Value of Ultrasound-Guided Interventional Therapy for Knee Joint Effusion. China Reflexology. 2019; 28(18): 148-150.

[8] Li X, Zhao Q, Wang L, et al. Advances in Surgical Treatment for Degenerative of Knee Osteoarthritis. Hebei Medicine. 2017; 23(9): 1577-1579.

[9] Zhou X, Huang S, Chen G, et al. Clinical Study on Ultrasound-Guided Suprapatellar Pouch Injection with 20% Glucose for Knee Osteoarthritis. Chinese Journal of Pain Medicine. 2022; 28(10): 787-790.

[10] He B, Liu Y, Wang P. Study of gait characteristics on the treatment of radiofrequency acupuncture under ultrasound visualization for early and middle knee osteoarthritis. Tianjin Journal of Traditional Chinese Medicine. 2022; 5: 39.

[11] Hu B, Chai D, Zhang F, et al. Clinical Efficacy of Musculoskeletal Ultrasound-Guided Radial Shock Wave Therapy Combined with Knee Muscle Strength Training in the Treatment of Knee Osteoarthritis. Medical Diet and Health. 2021; 19(11): 149-150.

[12] Chen Q. Evaluation of the Efficacy of Color Doppler Ultrasound in the Early Medical Management of Knee Osteoarthritis. Modern Medical Imageology. 2021; 30(10): 1950-1952.