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Original Article

The treatment efficacy of closure treatment for rheumatoid arthritis: a retrospective analysis of rheumatoid arthritis patients' clinical data

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Abstract: Objective: To analyze the therapeutic effect of experimental closure treatment for rheumatoid arthritis by analyzing the changes in the visual analog scale (VAS) scores and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores in patients with rheumatoid arthritis after experimental knee closure treatment. Methods: The clinical data of 216 cases with rheumatoid arthritis of the knee joint were retrospectively analyzed. The patients were divided into three groups based on the results of the ultrasonic scores of their joint lesions: the score 1 group (99 patients), the score 2 group (63 patients), and the score 3 group (54 patients). The VAS scores and the WOMAC osteoarthritis index scores were recorded. The closure index was calculated, and the patients' serum high-sensitivity C-reactive protein (hs-CRP), rheumatoid factor (RF), and tumor necrosis factor α (TNF-α) levels were measured and recorded before and after their treatment. Results: The higher the ultrasound score of the joint lesion, the higher the VAS scores and WOMAC osteoarthritis index scores ($P<0.05$). The VAS scores and the WOMAC osteoarthritis index scores at 1 week, 2 weeks, and 1 month after the closure treatment were lower than they were preoperatively in the three groups ($P<0.05$). The hs-CRP, RF, and TNF-α levels were lower at 1 week, 2 weeks, and 1 month after the closure therapy than they were preoperatively in the three groups ($P<0.05$). Conclusion: The application of closure therapy enables physicians to effectively locate knee joint lesions in patients with rheumatoid arthritis. Closure therapy improves the VAS scores and the WOMAC osteoarthritis index scores and relieves pain.

Keywords: Rheumatoid arthritis, experimental closure treatment, VAS scores, WOMAC osteoarthritis index scores

Introduction

Rheumatoid arthritis is commonly observed in young adults, has a higher incidence in women than in men, and is an autoimmune disease that involves synovitis and extra-articular lesions [1]. Rheumatoid arthritis is the leading cause of the loss of the young labor force and even disabilities in young adults. It induces a great impact on the lives of the patients, brings huge economic pressure to the families and patients, and is one of the major human diseases causing disabilities. The extremely high incidence, high morbidity, and high cost of the treatment exert a huge negative impact on the work and life of patients with rheumatoid arthritis and make rheumatoid arthritis one of the most important diseases hindering economic and societal development. Therefore, finding better treatments for rheumatoid arthritis is a big concern among clinicians [2-4].

The visual analog scale (VAS) score [5] is a simple and practical scale for pain evaluation. The VAS is regarded as a very sensitive and reliable method for measuring pain in clinics. The WOMAC index [6] is a method of pain measurement invented and advocated by the American Rheumatoid Arthritis Clinical Research Group to evaluate the pain and dysfunction caused by the disease in the form of a self-assessment questionnaire. The two questionnaires are currently the most extensively used methods for the evaluation of rheumatoid arthritis and are

applied in many studies to assess the extent of the illness and the therapeutic effect of the patients with rheumatoid arthritis [7, 8].

There are many treatment protocols for early rheumatoid arthritis, most of which are mainly conservative treatment, including rehabilitation physical therapy, oral medication, and intra-articular injections, but these treatments are not highly specific, and the clinical effect is unsatisfactory. Total knee arthroplasty is required when the illness reaches an advanced stage, but in this case, the family of the patient has to pay a large amount for the medical expenses, and the patients will experience postoperative complications, including infections, a loosening of the prosthesis, fractures, and non-inducement pain, etc., as well as the need for additional surgery; in addition, the qualitative indications for rheumatoid arthritis surgery are rarely studied, and research on the prediction of the postoperative curative effect preoperatively is seldom done [9-11]. Knee joint closure experimental treatment enables the provision of qualitative indicators for knee arthroscopy for the treatment of arthritis and predicts the efficacy after knee arthroscopy for the minimally invasive treatment of knee osteoarthritis, and provides a reference for clinicians [12].

This experiment explored the VAS score and WOMAC osteoarthritis index score changes in patients with rheumatoid arthritis after knee joint closure treatment and analyzed the treatment efficacy of the closure treatment for rheumatoid arthritis through a retrospective analysis of the clinical data of 72 patients with rheumatoid arthritis.

Materials and methods

General information

The clinical data of 216 patients with rheumatoid arthritis of the knee joint were retrospectively analyzed. Among all the cases, 72 were men and 144 were women, with an age range of 20-50 years and a mean age of 33.6±5.6 years. The patients were divided into three groups based on the results of the ultrasonic scores of their joint lesions [13]: the score 1 group (99 patients), the score 2 group (63 patients), and the score 3 group (54 patients). All the patients underwent experimental closure treatment, and the VAS scores and WOMAC osteoarthritis index scores before, at 1 week after the surgery, at 2 weeks after the surgery, and at 1 month after the closure treatment were recorded. The patients' closure index values were also calculated. The inclusion criteria were: definite symptoms of rheumatoid arthritis and meeting the diagnostic criteria of rheumatoid arthritis established by the American Rheumatism Association in 1987 [14], the exclusion of any other surgeries on the knees of the patients in the past three years, voluntarily agreeing to undergo the closure experiment and arthroscopic surgery, and previous unsuccessful use of oral or topical nonsteroidal anti-inflammatory drugs. The exclusion criteria were: history of cardiovascular disease, liver, or kidney disease, neurological and psychiatric disorders, chronic pain syndrome, alcohol or drug abuse; language difficulties, noncompliance with treatment, local anesthetic allergies; knee joint bone tumors, bone metastasis; and patients who recently suffered an acute stroke. This study was approved by our hospital and the patients or their families provided signed informed consents.

Knee joint closure experiment

In a sitting position, the patients' knees were routinely disinfected, and a sterile towel was spread over the knee. The knee joint was flexed at 60°-90°. Paracentesis of the lateral margin of the patella was performed, 5-ml 2% (quality concentration) lidocaine (Tianjin Kingyork Pharmaceutical Co., Ltd.; strength, 5 ml: 0.1 g) was injected, and an aseptic paste was used to cover the pin holes.

Observation index

We administered the VAS and WOMAC osteoarthritis index questionnaires at 1 week, 2 weeks, and 1 month after the closure treatment. The higher the score and index, the stronger the pain. The serum hs-CRP, RF, and TNF-α levels were recorded before and after the treatment. The closure index = (VAS score before the closure - VAS score after the closure)/VAS score before the closure × 100%, closure effective group (closure index ≥25%) and closure ineffective group (closure index <25%). Effective rate = closure effective group/(closure effective group + closure ineffective group) × 100%.

Table 1. General information

	Score 1 group	Score 2 group	Score 3 group	statistic	*p*-value
Sex [n (%)]				0.355	0.73
male	30 (30.30)	29 (46.03)	17 (31.48)		
female	69 (39.70)	44 (53.97)	37 (68.52)		
Average age (years)	32.5±5.4	33.6±5.5	34.7±5.6	2.894	0.06
Weight (Kg)	51.24±7.39	50.48±7.94	52.33±7.56	0.867	0.42
Course of disease (months)	9.87±3.59	17.44±8.30	26.43±11.16	85.26	<0.001
Smoking history [n (%)]				4.566	0.12
yes	73 (73.74)	49 (77.78)	37 (68.52)		
no	26 (26.26)	14 (22.22)	17 (31.48)		
Anti CCP antibodies [n (%)]				4.571	0.07
feminine	90 (90.91)	57 (90.48)	49 (90.74)		
positive	9 (9.09)	6 (9.52)	5 (9.26)		
ESR [n(%)]				3.714	0.20
normal	82 (82.83)	52 (82.54)	44 (81.48)		
rise	17 (17.17)	11 (17.46)	10 (18.52)		

Table 2. The effect of the closed experimental treatment of the knee joint

	Score 1 group	Score 2 group	Score 3 group	statistic	*p*-value
Headcount	99	63	54		
Valid	92	56	39		
Invalid	7	7	15		
Efficient	92.93%	88.89%	72.22%	23.94	0.01

Statistical analysis

Statistical methods: SPSS 22.0 software (Asia Analytics Formerly SPSS China) was used for the statistical analysis. The count data were expressed as $\bar{X}\pm S$, and the measurement data were described by the rate. X^2 tests were used to compare the count data, and an analysis of variance was used to compare the measurement data among multiple groups. Paired t tests were used to compare the two groups, and the analysis of variance of repeated measurement was adopted to analyze the different time points within a group.

Results

General information

Among the 216 patients with rheumatoid arthritis, 99 patients were in the score 1 group, including 30 male and 69 female patients, with a mean age of 32.5±5.4 years. The score 2 group comprised 63 patients, including 29 male and 44 female patients, with a mean age of 33.6±5.5 years. The score 3 group comprised 54 patients, including 17 male and 37 female patients, with a mean age of 34.7±5.6 years. The disease courses in the three groups of patients were different (P< 0.05). The higher the score, the longer the course of the disease. The mean age, sex ratio, and the other basic data of the three groups of patients were not significantly different (P>0.05) (**Table 1**).

The effect of the knee joint experimental closure treatment

One month after the closure treatment, the closure therapy had a good curative effect among the patients in the score 1 group, and the effective rates of the score 1, 2, and 3 groups, were 92.93%, 88.89%, and 72.22%, respectively. The effective rates of the closure treatment in the three groups were significantly different (P<0.05) (**Table 2**).

The VAS scores before and after the closure treatments

The VAS scores before, at 1 week, and at 1 month after the closure treatment were different in the three groups, and the VAS scores were the highest in the score 3 group, in the middle in the score 2 group, and the lowest in

Table 3. The VAS scores before and after the treatment

	Score 1 group	Score 2 group	Score 3 group	statistic	*p*-value
Pretreatment	7.1±0.7	7.5±0.8	8.1±1.1	15.27	<0.01
1 week after treatment	4.3±0.2	4.9±0.5	6.1±0.9	149.9	<0.01
2 weeks after treatment	3.6±0.5	4.0±0.4	5.3±0.6	2.785	0.25
1 month after treatment	3.1±0.3	3.4±0.2	4.0±0.4	26.28	<0.01

Table 4. The WOMAC osteoarthritis index scores before and after the treatment

	1. Grouping	2. Grouping	3. Grouping	statistic	*p*-valued
Pretreatment	6.8±0.8	7.6±0.7	8.2±1.3	27.25	<0.01
1 week after treatment	4.6±0.6	5.2±0.5	6.6±0.7	6.419	0.04
2 weeks after treatment	3.4±0.6	3.8±0.7	4.3±0.6	2.159	0.34
One month after treatment	2.8±0.4	3.2±0.3	3.9±0.5	14.59	<0.01

the score 1 group (P<0.05). The VAS scores at 1 week after closure treatment were not significantly different in the three groups (P>0.05). The VAS scores at the same time points between the two groups were significantly different (P<0.05). After the treatment, the VAS scores of the three groups gradually decreased, and the VAS scores within the group were reduced at 1 week, 2 weeks, and 1 month after the closure treatment compared to their levels before the closure treatment in the three groups (P<0.05). The VAS scores at 2 weeks and 1 month after the closure treatment were lower than they were at 1 week after the closure treatment in the three groups (P<0.05). The VAS scores at 1 month after the closure treatment were lower than they were at 2 weeks after the closure treatment in the three groups (P<0.05) (**Table 3**).

The WOMAC osteoarthritis index scores before and after the closure treatment

The WOMAC osteoarthritis index scores before, at 1 week after, and at 1 month after the closure treatment were different in the three groups, and the WOMAC osteoarthritis index scores were the highest in the score 3 group, in the middle in the score 2 group, and the lowest in the score 1 group (all P<0.05). The WOMAC osteoarthritis index scores 2 weeks after the closure treatment were not significantly different in the three groups (P>0.05). The WOMAC osteoarthritis index scores at the same time points between the two groups were statistically different (P<0.05). After the treatment, the WOMAC osteoarthritis index scores of the three groups gradually decreased, and the WOMAC osteoarthritis index scores within the groups at 1 week, 2 weeks, and 1 month after the closure treatment were lower than they were before the closure treatment in the three groups. The WOMAC osteoarthritis index scores at 2 weeks and 1 month after the closure treatment were lower than they were at 1 week after the closure treatment in the three groups (P<0.05). The WOMAC osteoarthritis index scores at 1 month after the closure treatment were lower than they were at 2 weeks after the closure treatment in the three groups (P<0.05) (**Table 4**).

The hs-CRP, RF, and TNF-α levels before and after the closure treatment

The hs-CRP levels were different at 1 week, 2 weeks, and 1 month after the closure treatment in the three groups (P<0.05). The TNF-α levels at 2 weeks after the closure treatment were different in the three groups (P<0.05), and the higher the scores, the higher the hs-CRP and TNF-α levels. The RF levels at the four time points were not different (P>0.05), and the hs-CRP and TNF-α levels were not different at the other time points in the three groups (P>0.05). The hs-CRP, RF, and TNF-α levels at the same time points were significantly different according to the pairwise comparison (P<0.05). After the treatment, the hs-CRP, RF, and TNF-α levels of the three groups gradually decreased, and the hs-CRP, RF, and TNF-α levels within the groups were reduced at 1 week, 2 weeks, and 1 month after closure treatment compared to their levels before the closure treatment in the

Table 5. Changes in the hs-CRP levels before and after the treatment (mg/L)

	1. Grouping	2. Grouping	3. Grouping	statistic	*p*-valued
Pretreatment	40.59±6.84	41.22±7.01	45.78±8.29	2.839	0.24
1 week after treatment	31.40±4.32	33.59±5.69	40.19±5.73	7.948	0.02
2 weeks after treatment	21.86±3.47	23.68±4.56	26.07±5.21	12.66	<0.01
One month after treatment	17.48±2.33	18.24±2.75	21.33±3.29	8.579	0.01

Table 6. Changes in the RF levels before and after the treatment (U/mL)

	1. Grouping	2. Grouping	3. Grouping	statistic	*p*-valued
Pretreatment	182.17±16.19	217.36±18.44	232.88±17.28	1.308	0.52
1 week after treatment	167.09±12.30	188.55±13.46	208.23±15.71	4.265	0.12
2 weeks after treatment	156.33±11.09	173.45±13.18	194.09±13.41	3.399	0.18
One month after treatment	149.89±9.82	154.69±10.22	188.36±10.60	0.417	0.81

Table 7. Changes in the TNF-α levels before and after the treatment ($pg{\cdot}ml^{-1}$)

	1. Grouping	2. Grouping	3. Grouping	statistic	*p*-valued
Pretreatment	36.02±9.99	42.13±10.39	54.60±11.86	2.140	0.34
1 week after treatment	28.71±7.05	37.83±7.89	44.93±8.05	1.572	0.46
2 weeks after treatment	24.71±4.14	25.01±4.67	26.12±5.64	6.856	0.03
One month after treatment	16.04±2.19	21.47±2.13	24.21±2.50	1.750	0.42

Table 8. Results of the Pearson correlation analysis

	VAS score	WOMAC
hs-CRP	r=0.773	r=0.841
	P<0.001	P<0.001
RF	r=0.795	r=0.713
	P<0.001	P<0.001
TNF-α	r=0.728	r=0.745
	P<0.001	P<0.001

three groups. The hs-CRP, RF, and TNF-α levels at 2 weeks and 1 month after the closure treatment were lower than they were at 1 week after the closure treatment in the three groups (P<0.05). The hs-CRP, RF, and TNF-α levels at 1 month after the closure treatment were lower than they were at 2 weeks after the closure treatment in the three groups (P<0.05) (**Tables 5**-**7**).

Pearson correlation analysis

The result of the Pearson correlation analysis showed that the VAS and WOMAC osteoarthritis index scores were positively correlated with the hs-CRP, RF, and TNF-α levels, and the lower the VAS and WOMAC osteoarthritis index scores of the patients, the lower the serum hs-CRP, RF, and TNF-α levels, and the greater the relief from pain (**Table 8**; **Figures 1**, **2**).

Discussion

Surgical treatment is a commonly used clinical treatment for patients with rheumatoid arthritis, but the treatment cycle is long, the patients' recovery of their knee joint function is slow, and the best therapy period is always missed due to the difficulty in determining the patients' lesion positions [3, 15]. Therefore, we hope this study will provide more indications for clinical operations and improve the status of clinical operation for rheumatoid arthritis.

In this study, lidocaine was administered alone for the closure treatment, and the effect of the closure therapy was studied by observing the VAS and WOMAC osteoarthritis index scores, which was innovative. This study was conducted in strict compliance with the inclusion and exclusion criteria, reducing the sample selection error to the maximum extent.

The results of this study showed that the efficacy of closure treatment was better in the score 1 group at 1 month after the closure

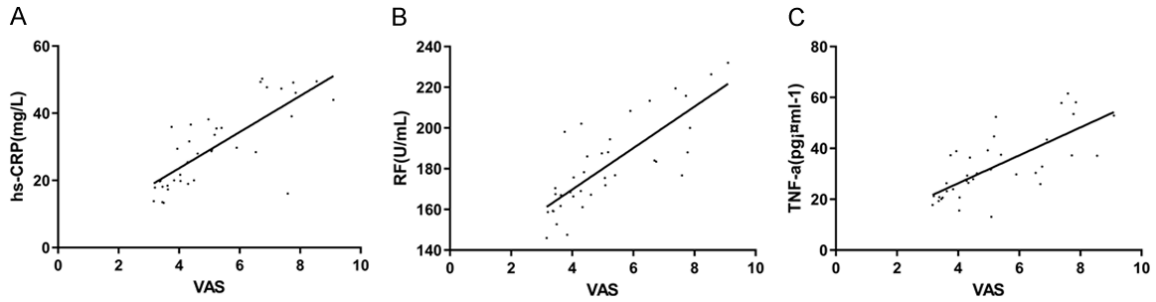

Figure 1. A. Correlation analysis of the vas and hs CRP. r=0.773, P<0.001. B. Correlation analysis of the vas and RF. r=0.795, P<0.001. C. Correlation analysis of the vas and TNF-α. r=0.728, P<0.001.

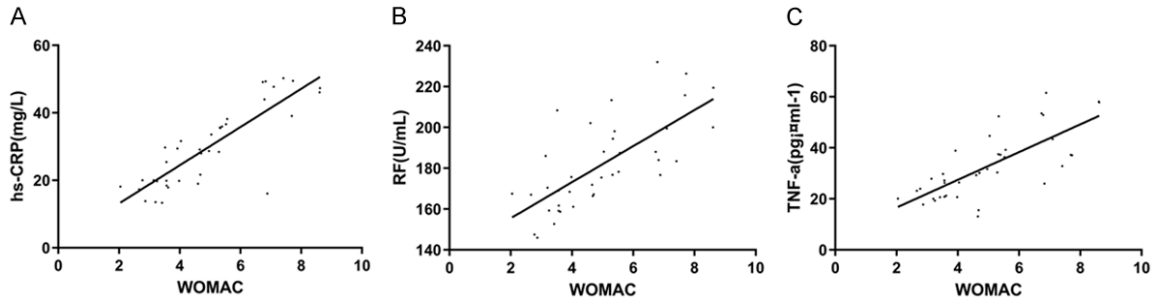

Figure 2. A. Correlation analysis of WOMAC and hs-CRP. r=0.841, P<0.001. B. Correlation analysis of WOMAC and RF. r=0.713, P<0.001. C. Correlation analysis of WOMAC and TNF-α. r=0.745, P<0.001.

treatment, and the higher the score, the lower the effective rate of the closure therapy, which indicated that the earlier rheumatoid arthritis was treated, the better the efficacy of the closure treatment, and the higher the success rate of the lesion location. Li et al. [16] also showed that the closure therapy has a good therapeutic effect in osteoarthritis of the knee joint, and it is worthy of clinical promotion. Zhong et al. [17] found that closure therapy significantly reduces pain caused by scapulohumeral periarthritis, a finding similar to our results and proved by the patients' VAS scores and WOMAC osteoarthritis index scores that the lower the ultrasound scores of the joint lesions, the lower the VAS scores and WOMAC osteoarthritis indexes. The VAS and WOMAC osteoarthritis index scores decreased after the closure treatment in the three groups, but the improvement is better, and the degree of pain relief is higher for patients with lower ultrasonic joint lesion scores. At the same time, the patients' inflammatory factor levels were statistically analyzed. The results showed that closure therapy can effectively improve the hs-CRP, RF, and TNF-α levels and has a better effect on patients with lower joint lesion ultrasound scores. Arthritis pain is closely related to the level of inflammation in patients with rheumatoid arthritis, so improving the inflammatory factor levels is very effective at relieving patients' joint pain [18]. The results of the Pearson correlation analysis also showed that patients with lower VAS and WOMAC osteoarthritis index scores had lower serum hs-CRP, RF, and TNF-α levels and greater pain relief, but the hs-CRP and TNF-α levels are more sensitive to pain relief in patients with rheumatoid arthritis.

Therefore, the closure may improve the inflammatory factor levels to relieve pain in patients. However, the different inflammatory factors are different in how they relate to patients' degree of pain. The closure treatment experiment only administered lidocaine; the improvement degrees of the various inflammatory factor levels were found to be different, and the improvement effects on the hs-CRP and TNF-α levels were significantly superior to those of the RF levels. We presumed that differences in the improvement degree of lidocaine on the different levels of the inflammatory factors may be an important factor causing closure treatment failure, and lidocaine was limited to the improve-

ment of the inflammatory factors. The closure treatment failure may also be induced by the experimental design defects, because this study did not design different lidocaine dosages for the patients with different joint lesion ultrasonic scores, and we will conduct further research on the problems identified in this study. The closure treatment experiment is very extensively used to treat joint disease, but it is rarely reported for the treatment of rheumatoid arthritis [19]. Therefore, all the conclusions in this study need to be verified by more data, and at the same time, this research only explored rheumatoid arthritis of the knee joint, so it requires further study on whether closure treatment has the same effect in the treatment of rheumatoid arthritis in other joints.

In summary, the application of closure treatment can effectively locate the knee joint lesions of patients with rheumatoid arthritis, and the lower the ultrasound score of the joint lesion, the better the efficacy; at the same time, closure therapy can effectively reduce patients' inflammatory factor levels, improve their VAS and WOMAC osteoarthritis index scores, relieve pain, and make the curative effect ideal, so it is worthy of promotion in clinical practice.

Disclosure of conflict of interest

None.

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