ORIGINAL RESEARCH

Comparison of Therapeutic Effects Between Arthroscopic Debridement and Olecranon Fossa Augmentation Plasty for Elbow Osteoarthritis

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ABSTRACT

Aim • To compare the efficacy of arthroscopic debridement and olecranon fossa augmentation plasty in patients with elbow osteoarthritis.

Methods • Eighty-four patients with elbow osteoarthritis admitted to our hospital were randomly divided into two groups with 42 cases in each group. Patients in the control group received expanded olecranon fossa plasty, while those in the observation group underwent arthroscopic debridement. Then the elbow joint function, VAS score, stress level, and incidence of complications were compared between the two groups.

Results • The MEPS score, ROM level, and VAS score, as well as the expression of TNF-α, IL-6, and ACTH between the two groups, were significantly different before and after surgery ($P < .05$). Moreover, compared to patients in the control group, the MEPS score and ROM level of patients in the observation group were higher than those in the control group after six months since surgery, while VAS score, the levels of TNF-α, IL-6, and ACTH were lower on the second day after surgery ($P < .05$).

Conclusion • Arthroscopic cleaning is more helpful in improving elbow joint function and alleviating pain in patients with osteoarthritis of the elbow compared to olecranon fossa augmentation and reconstruction surgery. (*Altern Ther Health Med.* 2023;29(8):292-296).

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INTRODUCTION

With the gradual aggravation of the aging population, the incidence of osteoarthritis has increased year by year, and the disease has received more and more attention.[1] The elbow joint has a high degree of flexibility, and is a hinged structure in the human body, which is composed of the ulnar joint, the brachioradial joint, and the proximal radial ulnar joint; and, its structure and function are complex, with extension and rotation functions. The elbow joint is the most flexible system of the human body. The blood vessels and ligaments are abundant and closely integrated with the joint. If the elbow joint is injured, arthritis will be induced.[2] At this time, the joint capsule will adhere to the surrounding tissues, thereby limiting the range of motion. Elbow osteoarthritis accounts for a low proportion of osteoarthritis in all joints of the whole body, and most of the patients are middle-aged and elderly, with an average age of onset of 55 years.[3,4] The main clinical manifestations of elbow osteoarthritis are limited elbow joint movement, pain, and painful snapping, and the main pathological features are elbow joint bone hyperplasia and elbow cartilage destruction.[5]

Clinically, the treatment methods for elbow osteoarthritis are mainly conservative and surgical, and the main methods of conservative treatment include drug, physical, and Chinese medicine. Surgical treatment mainly includes traditional open-release surgery and arthroscopic ankylosis, however, there is no obvious difference between traditional surgery and minimally invasive surgery in terms of long-term efficacy and treatment effect. Due to the special structure of the elbow joint, the space of the joint cavity is small, and there are abundant nerves and blood vessels around it, which increases the difficulty and risk of surgery. Conventional elbow joint dissection and release surgery has a greater trauma, and rehabilitation training is more difficult to carry out, making it difficult to predict and judge the postoperative effect.[6-8] Arthroscopic surgery has been widely used since its first application because of its wide field of vision, small postoperative injury, early functional training, and other advantages, and can remove and repair the adhesion on the joint surfaces. In recent years, joint dissection under arthroscopy has gradually become the first choice for the

treatment of osteoarthritis, with small wounds and fast recovery after the operation.[9] Studies have shown that olecranioplasty increases joint stability.[10] Desmoineaux[11] reported that in the treatment of elbow osteoarthritis, if necessary, the lesions of the anterior capsule of the joint can be effectively treated through the humeral passage from the olecranon fossa to the coronary fossa. At present, there are few studies comparing the efficacy of arthroscopic cleansing and olecranon fossa plasty in the treatment of elbow osteoarthritis. This study compares the efficacy of arthroscopic cleansing with olecranon fossa plasty in the treatment of patients with elbow osteoarthritis.

Elbow osteoarthritis is more common in men with manual labor, who are usually older than 40 years of age.[12] Reactive bone and osteophytes form in the coronary and olecranon processes of the patient, resulting in elbow joint dyskinesia with terminal pain, which severely affects the patient's quality of life.[13,14] Common physical therapy can partially restore elbow function, but it is often accompanied by persistent elbow joint pain. Joint debridement under arthroscopy is a commonly used method in the clinical treatment of elbow osteoarthritis.[5] This operation is minimally invasive and has little impact on the postoperative recovery of patients.[15]

Previous studies have shown that enlarged olecranon fossa plasty improves elbow flexion.[16] However, patients with severe elbow osteoarthritis often have severe capsular contracture, a large number of osteopathy, and narrow space, resulting in the arthroscopic inability to enter the joint space, and intraoperative clearance of the upper radioulnar joint and release of the ulnar nerve. During the arthroscopic release, the field of view is poor, the space is narrow, and it is easy to damage the ulnar nerve. Hence, Zhang Chuan et al.[17] recommended that a small incision should be made at the beginning of arthroscopic surgery to release free and protect the ulnar nerve. Rotoplasty is a modified method of brachial ulnar arthroplasty (Outerbridge-Kashiwagi, (O-K)). It can improve elbow motion by removing posterior osteophytes under direct vision and reaching the anterior compartment through the olecranon fossa fenestration channel to remove the anterior osteophytes,[18-20] coronal osteophytes, and synovium tissue. The ulnar nerve sulcus can be exposed medial for ulnar nerve sulcus enlargement.[21] In the case of concomitant rotation restriction, the superior radioulnar joint may be exfoliated laterally to clear the hyperplasia and calcification of the annular ligament at this site. Cohen[22] compared the effect of the completely open Outerbridge-Kashiwagi operation with that of the humeral fenestration under arthroscopy in the treatment of elbow osteoarthritis, and concluded that both of them have satisfactory effects in elbow joint cases without major complications. It concluded that arthroscopic humeral olecranial fenest is more advantageous in terms of pain relief, while open humeral ulnar plasty is more beneficial in terms of improved range of motion.

The main neuroendocrine changes in the stress response are intense excitation of the blue-sympathetic-adrenal medulla and hypothalamic-pituitary-adrenal axis, and most physiological and pathological changes in the stress response are related.[23] Adrenocorticotropic hormone (ACTH) which is secreted by the pituitary gland, rises rapidly in response to stress. Tumor necrosis factor α (TNF-α) is produced by the immune modulator generated by the activation of immune cells in response to stress in the acute phase, which is part of the stress response system, therefore detecting changes in TNF-α cytokine level reflects the intensity of the stress response.[24] Interleukin-6 (IL-6) is secreted by monocytes and macrophages under stimulation such as surgical injury and can act on a variety of target cells in the body, which can not only be used as an important marker of tissue damage but also play an important role in the body's stress response after injury.[25]

MATERIALS AND METHODS

General information

Eighty-four patients with severe elbow osteoarthritis admitted to our hospital from January 2020 to April 2021 were randomly divided into two groups, with 42 cases in each group. The age of patients in the observation group ranged from 36 to 64 years, with an average age of (48.2 ± 8.2) years, while the age of patients in the control ranged from 35 to 63 years, with an average age of (47.5 ± 7.4) years. There was no significant difference in age, disease type, and other general information between the two groups ($P > .05$).

Inclusion and exclusion criteria

Inclusion criteria: (i) All patients met the diagnostic criteria for severe elbow osteoarthritis;[26] (ii) the diagnosis was confirmed by imaging; (iii) elbow range of motion: flexion angle-extension = 0°-90°; (iv) age < 65 years; (v) the case data were complete and the interviews were completed as scheduled; and, (vi) all participants have signed informed consent in advance.

Exclusion criteria: (i) Severely infected patients; (ii) patients with malignant neoplasm; (iii) patients without good compliance; (iv) rheumatic and rheumatoid arthritis patients; (v) patients with prior elbow fractures; (vi) patients with mental disorders; and, (vii) patients who are unable to respond to treatment.

Methods

The patients in the control group underwent dilatation of the olecranon fossa. During the operation, the patient was placed in a supine position with brachial plexus block anesthesia. The upper part of the affected arm was tied with a tourniquet, along with routine disinfection and towel placement. The affected upper limb was placed on the chest by an assistant in the position of adduction and flexion elbow. The posterior median incision of the affected elbow was made, with a length of about 12 cm. If necessary, the incision could be extended upward and lower to expose the ulna and triceps fascia. The triceps was sharply severed at the attachment of the triceps ulna olecranon, exposing the posterior structure of the elbow joint. The medial and lateral columns of the humerus

and the olecranon of the ulna were visible. A bone knife or high-speed drill was used to remove the hyperplasia around the olecranon. If necessary, part of the tip of the olecranon could be removed. The olecranon fossa could be fully exposed with extreme elbow flexion (the diameter and the depth of the fenestration were measured on preoperative CT). The principle of the window opening is to have a large outer opening and a small inner opening and tilting to the ulnar side appropriately. When grinding, rinse the area with physiological saline and suck it out in a timely manner to reduce the incidence of ectopic ossification. The structure of the anterior compartment of the elbow joint can be observed through the window. The extreme flexion of the elbow joint will bring the coronoid process close to the window. The gun bone rongeur is used to remove the hyperplastic osteophyte of the coronoid process. If necessary, the stripper is used to properly release the anterior articular capsule and pay attention to protecting the blood vessels and nerves. During the surgery, the elbow joint should be extended and flexed at any time, and the position and range of release should be determined based on limited extension and flexion. If combined with limited rotation, the upper radioulnar joint can be exposed by lateral dissection, and the proliferative osteophytes and calcified circular ligaments in this area can be cleared. After the range of motion of the elbow was restored, the bone surface and surrounding soft tissues were rinsed with a large amount of normal saline, bone wax was applied to the surface of the bone window, a bone anchor was implanted at the tip of the olecranon of the ulna, the triceps muscle was sutured *in situ*, a negative pressure drainage tube was placed, and the incision was sutured.

The patients in the observation group underwent arthroscopic debridement. The patient was placed a in lateral position and received brachial plexus block anesthesia. The shoulder joint was flexed forward at 90° and the elbow joint was naturally flexion and sagging. The soft points of the elbow were marked. A sterile tourniquet was applied, and the elbow cavity was filled with 20 ml saline containing a small amount of epinephrine injected through the soft spot. The skin was cut open, the exchange rod was inserted into the arthroscopic sheath, and the normal saline was discharged into the elbow joint. Anterior ventricular access was established through the proximal anteromedial approach and proximal anterolateral approach, and posterior ventricular access was established through the posterolateral approach and posterior median approach. The proliferative synovium was removed under the microscope to fully expose the anterior and posterior chambers of the elbow joint. The hyperplastic osteophytes, especially the radial fossa, coronal fossa, olecranon tip, and olecranon fossa, were resected according to preoperative imaging. The olecranon fossa and radial fossa could be reconstructed at the same time to fully restore elbow extension and flexion. Then part of the annular ligament and hyperplastic scar tissue located in the adjacent to ~~of~~ the superior radioulnar joint was excised, and finally, the anterior and posterior joint capsules were excised. After the anterior and posterior cleaning was completed, the rotation and extension function of the elbow joint was observed under the microscope. The drainage tube was placed and the incision was sutured when no abnormality was confirmed. The drainage tube was removed 24 to 48 hours after surgery.

Observed indicators

Mayo Elbow Function Score (MEPS) and elbow range of motion (ROM) were compared between two groups before and after surgery and after 6 months post-surgery. The MEPS scale refers to the scale described in Xu Jinglei et al,[27] including extension function (20 points), pain (45 points), the function of daily living (25 points), and joint stability (10 points). The full score is 100. The higher the score, the better the function. ROM is the angle between full flexion and full extension of the elbow.

The evaluation is based on the Visual Analogue Scale of pain (VAS),[28] which uses a scale marked with 10 points: 0 is painless, 3 or less is mild pain, 4-6 is moderate, and 7-10 is severe.

Venous blood was collected before and 7 days after operation, and centrifuged (3000 r/min, 15min), and the supernatant was taken and refrigerated at -80°C. The levels of TNF-α, IL-6, and ACTH in serum were detected by ELISA, which was purchased from Shanghai Enzyme Biotechnology Co., Ltd. Postoperative follow-up was conducted for one year and the complications were recorded.

Statistical analysis

SPSS 26.0 software was used to analyze the data, and the Shapiro-Wilk test was conducted to test normality. The measurement data of normal distribution were represented by ($\bar{x} \pm s$), and t test was used for comparison between groups. Statistical data were expressed as frequency (%), and the χ^2 test was used for comparison between groups. $P < .05$ meant the difference was statistically significant.

RESULTS

Comparison of elbow joint function

There was no significant difference in MEPS score and ROM level between two groups before operation ($P > .05$), which were both higher than before treatment ($P < .05$). Moreover, the MEPS score and ROM level of the observation group were higher than the control group ($P < .05$) six months after surgery (Table 1).

VAS score

There was no significant difference in VAS scores between the two groups before the operation ($P > .05$). Six months after surgery, the VAS score of both groups was lower than that before the surgery. The VAS score was observed to be lower in the observation group than in the control group (Table 2).

Comparison of stress levels

There were no significant differences in the levels of TNF-α, IL-6, and ACTH between the two groups before

Table 1. The Comparison of MEPS Scores and ROM Levels Between Two Groups ($\bar{x} \pm s$)

Groups	n	MEPS		*t*	*P* value	ROM (°)		*t*	*P* value
		Before surgery	After surgery			Before surgery	After surgery		
Control group	42	56.21 ± 8.64	71.21 ± 8.65	8.265	.000	83.54 ± 15.24	107.34 ± 16.34	6.675	.000
Observation group	42	56.33 ± 8.72	77.45 ± 8.48	11.523	.000	83.62 ± 15.17	114.95 ± 18.21	8.567	.000
t		0.063	3.338			0.024	2.016		
P value		.950	.001			.981	.047		

Table 2. The Comparison of VAS Score Levels Between Two Groups ($\bar{x} \pm s$)

Groups	n	VAS		*t*	*P value*
		Before surgery	After surgery		
Control group	42	4.21 ± 0.84	2.12 ± 0.67	14.568	.000
Observation group	42	4.24 ± 0.88	1.66 ± 0.48	16.680	.000
t		0.127	3.617		
P value		.899	.001		

Table 3. The Comparison of Stress Levels Between Two Groups ($\bar{x} \pm s$)

Groups	n	TNF-α (μg/L)		IL-6 (ng/L)		ACTH (ng/L)	
		Before surgery	1 day after surgery	Before surgery	1 day after surgery	Before surgery	1 day after surgery
Control group	42	13.52 ± 2.51	9.62 ± 1.41[a]	5.65 ± 1.92	4.13 ± 1.66[a]	22.69 ± 6.47	19.14 ± 5.21[a]
Observation group	42	13.25 ± 2.61	8.34 ± 1.22[a]	5.69 ± 1.98	3.05 ± 0.84[a]	22.71 ± 6.49	16.33 ± 4.87[a]
t		0.483	4.449	0.094	3.762	0.014	2.554
P value		.630	.000	.925	.000	.989	.013

[a]$P < .05$ vs control group

Table 4. The Comparison of Incidence of Complications Between the Two Groups [n (%)]

Groups	n	Infection of incisional wound	Ulnar nerve injury	Total incidence of complications (%)
Control group	42	2	1	3 (7.14)
Observation group	42	1	0	1 (2.38)
χ^2				0.260
P value				.608

operation ($P > .05$). 1 day after surgery, the levels of TNF-α, IL-6, and ACTH in both groups were lower than those before surgery. The levels of TNF-α, IL-6, and ACTH in the observation group were lower than those in the control group, with a statistical difference ($P < .05$, Table 3).

Occurrence of complications

There was no statistical difference in the incidence of complications between the two groups ($P > .05$, Table 4).

DISCUSSION

In this study, MEPS score, ROM level, VAS score, and TNF-α, IL-6, and ACTH levels before and after surgery were compared between the two groups, and the differences were statistically significant ($P < .05$). The MEPS score and ROM score of the observation group were higher, and the VAS score of observation group was lower six months after operation ($P < .05$), while the levels of TNF-α, IL-6, and ACTH in observation group 1 day after surgery were lower than those in the control group, suggesting that arthroscopic cleaning is more helpful to improve elbow function and relieve pain in patients with elbow osteoarthritis than dilatation of olecranon fossa.

In elbow osteoarthritis patients with olecranon fossa and osteophyte hyperplasia, olecranon fossa enlargement plasty helps to release the joint capsule of the patient. A simple operation can remove hyperplastic osteophyte and scar tissue, with the patient's elbow joint extension and flexion exercise, so that the olecranon and corresponding olecranon fossa can be fully exposed, to improve the stability of the elbow joint.[29] On the other hand, arthroscopic debridement has a wide range of cleaning, which ensures the smooth and flat articular fossa, removes more hyperplasia and synovium during the operation, improves the range of motion of the joint, reduces the trauma, and causes less pain.[30] Liu et al.[31] showed that both arthroscopic elbow deactivation and olecranon fossa plasty ($P > .05$), indicating that arthroscopic clearance and dilatation of olecranon fossa have high safety.

CONCLUSION

In summary, olecranon fossa enlargement is suitable for patients with severe elbow osteoarthritis and ulnar neuritis with elbow rigidity. This operation is simple, does not affect the lateral stability of the elbow joint, and early functional exercise can be carried out. Furthermore, postoperative elbow joint flexion range of motion and pain can be significantly improved.

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AUTHOR DISCLOSURE STATEMENT

The text, charts, general condition of patients and other information displayed in the article and the remarks published by me are from our hospitalized patients, and are only for learning and communication, if there is any inaccuracy or infringement of your legitimate rights and interests, it has nothing to do with the magazine. There is no conflict of interest between the authors.

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