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Results of reconstruction of the upper capsule of the shoulder joint with the broad fascia of the thigh in patients with rotator cuff arthropathy

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Restoration of the upper capsule (superior capsule reconstruction) of the shoulder joint is one of the options for surgical treatment, which is performed for non-repairable ruptures of the rotator tendons with signs of rotator cuff arthropathy. The aim of the work is to investigate and compare the results of restoration of the upper capsule of the shoulder joint with a wide fascia of the thigh of different thicknesses. Materials and methods. We performed restoration of the upper capsule of the shoulder joint using a graft from the wide fascia of the thigh in 45 patients with rotator cuff arthropathy of the 2nd degree. The patients were divided into 2 groups depending on the characteristics of the surgical intervention: group 1 — restoration of the upper capsule was performed with a graft from the wide fascia of the thigh in 6 layers; group 2 — restoration of the upper capsule was performed with a graft from the wide fascia of the thigh in 8 layers. Results: At 6 months after surgery, the mean functional outcome on the Constant Shoulder Score scale was 20.5 ± 6.9 points in the 6-layer graft group, while the results were better in the 8-layer graft group, at 18.5 ± 16.2 points (p = 0.037). At 12 months after surgery, the mean functional outcome on the Constant Shoulder Score scale was 16.6±5.9 points in the 6-layer graft group, while the results were also better in the 8-layer graft group, at 12.9 ± 9.1 points (p = 0.022). Conclusion: The average short-term results (6–12 months) according to the Constant Shoulder Score and VAS scales of surgical repair of the upper capsule of the shoulder joint in patients of both groups, regardless of the thickness of the wide fascia of the thigh graft, were better than preoperative indicators.

Відновлення верхньої капсули (superior capsule reconstruction) плечового суглоба є одним із варіантів хірургічного лікування, який виконується в разі невідновних розривів сухожилків ротаторної манжети плеча (РМП) з ознаками ротаторної артропатії. Мета. Дослідити та порівняти результати відновлення верхньої капсули плечового суглоба широкою фасцією стегна різної товщини. Методи. Проведено відновлення верхньої капсули плечового суглоба за допомогою трансплантата з широкої фасції стегна 45 хворим із ротаторною артропатією плечового суглоба (ПС) 2 ст. Пацієнтів розділено на 2 групи залежно від особливостей втручання, відновлення верхньої капсули виконували трансплантатом з широкої фасції стегна, група 1 — 6 шарами; група 2 — 8. Результати. Через 6 міс. після операції, у 1 групі середній функціональний показник за шкалою Constant Shoulder Score склав (20,5 ± 6,9) балів, тоді як у 2 групі він був краще — 18,5 ± 16,2 (p = 0,037). Через 12 міс. після операції у 1 групі цей показник дорівнював (16,6 ± 5,9) бала, тоді як в 2 групі — 12,9 ± 9,1 (p = 0,022). Висновок. Середні короткострокові результати (6–12 міс.) за шкалами Constant Shoulder Score та візуальною аналоговою шкалою болю (ВАШ) хірургічного відновлення верхньої капсули плечового суглоба у хворих обох груп, не залежно від товщини трансплантата широкої фасції стегна були краще ніж доопераційні показники. Ключові слова. Ротаторна манжета плеча, ротаторна артропатія, сухожилок надостьового м'яза, плечовий суглоб.

Key words. Rotator cuff of the shoulder, rotator arthropathy, supraspinatus tendon, shoulder joint

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Introduction

Rotator cuff arthropathy of the shoulder joint (SJ) is a condition that develops as a result of an acute or chronic massive tear (involving two or more tendons) of the rotator cuff (RC) and is characterized by impaired RC muscle function, degenerative changes in the SJ, and cranial or cranioventral migration (displacement) of the humeral head [1–4].

Until recently, several surgical options were used to treat this group of patients: open RC tendon repair with side-to-side suturing of the supraspinatus tendon to the infraspinatus tendon, transfer of the latissimus dorsi tendon to the position of the external rotators (supraspinatus and infraspinatus muscles), insertion of synthetic subacromial balloon spacers such as the InSpace Balloon, and reverse or hemiarthroplasty (with a large humeral head) of the SJ [1–4].

Superior capsule reconstruction (SCR) of the SJ is one of the surgical treatment options performed for irreparable RC tendon tears with signs of rotator cuff arthropathy [1–4]. The number of these procedures has increased in recent years, primarily due to the growing availability of synthetic materials suitable for such reconstructions, as well as improvements in fixation devices (bone anchors) used in these surgical procedures.

The high rate of unsatisfactory outcomes associated with the use of synthetic materials for SCR of the SJ has shifted research toward autografts, among which the fascia lata has become one of the leading graft options.

Purpose: to investigate and compare the outcomes of SCR of the shoulder joint using fascia lata grafts of different thicknesses.

Materials and Methods

Between 2015 and 2024, 45 patients with stage II rotator cuff arthropathy of the SJ underwent SCR using a fascia lata graft at the Clinic of Reconstructive and Restorative Surgery of the Upper Extremity, SI "Institute of Traumatology and Orthopedics of the NAMS of Ukraine" (Kyiv). The patients ranged in age from 50 to 75 years, with a mean age of (61.9 ± 17.2) years.

The study was approved by the local Bioethics Committee (Protocol No. 6 dated 14.07.2025) of the respective institution in accordance with ICH GCP, the Helsinki Declaration on Human Rights and Biomedicine (1977 revision), and the current legislation of Ukraine. All enrolled patients were informed about the study protocol and conditions and provided both written and oral informed consent.

Patients were divided into two groups according to the surgical technique. SCR was performed using a fascia lata graft folded into six layers in Group 1 and eight layers in Group 2. The general characteristics of the groups are presented in Table 1.

Before surgery, all patients underwent clinical and radiographic evaluation, as well as MRI of the anatomical structures of the shoulder joint, including the SJ capsule at the level of the axillary pouch and the rotator interval. MRI was performed using T1-, T2-, PD-, and PD fat-saturated sequences.

The Global Fatty Degeneration Index (GFDI) is a parameter used in orthopedics to quantify the severity of fatty degeneration or infiltration in the RC muscles.

The GFDI was calculated as the mean Goutallier grade (0–4) assigned to the supraspinatus, infraspinatus, and subscapularis muscles based on MRI findings. A higher GFDI indicates more severe fatty infiltration and is associated with a poorer progno-

Table 1

Characteristics of the study groups

Indicator	Group 1 (n = 19)	Group 2 (n = 26)	p
Age (years)	57.50 ± 8.10	62.10 ± 12.90	0.501*
Sex: male/female (%)	3 (6.7) / 16 (35.5)	15 (33.3) / 11 (24.5)	0.382**
Number of graft layers	6	8	
Mean graft area (cm²)	14.40 ± 1.90	8.40 ± 0.50	0.560*
Global Fatty Degeneration Index (GFDI)	2.80 ± 0.50	2.60 ± 1.10	0.002*
Time from disease onset to surgery (months)	8.31 ± 3.91	8.70 ± 4.40	0.051***
Mean preoperative assessment: – according to VAS; – according to Constant Shoulder Score	 5.83 ± 3.90 48.90 ± 25.80	 5.70 ± 2.91 43.78 ± 20.00	 0.014* 0.054*

Notes: * — Student's t-test; ** — χ^2 test; *** — Mann–Whitney U test.

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sis, including an increased risk of retear and worse functional outcomes following rotator cuff surgery [1, 7, 10].

During the study, we assessed SJ function using the Constant Shoulder Score and the Visual Analog Scale (VAS) before surgery and at 3 and 6 months postoperatively. The Constant Shoulder Score ranges from a minimum of 8 to a maximum of 100 points. The affected and contralateral healthy upper limbs were compared. A difference of more than 30 points was considered a poor outcome, 21–30 points a fair outcome, 11–20 points a good outcome, and less than 11 points an excellent outcome [1].

The inclusion criteria were as follows:

stage II rotator cuff arthropathy of the SJ; absence of fractures of the proximal humeral metaphysis or the scapula, confirmed both clinically and by additional imaging studies (radiography and MRI); completion of the standard surgical protocol and postoperative rehabilitation program; and postoperative follow-up examinations at 6 and 12 months.

Surgical technique: patients were positioned in the beach-chair position. Standard posterior, posterolateral, lateral, and anterolateral arthroscopic portals were used to access the shoulder joint.

Intraoperative assessment was performed using a 4.5-mm arthroscope with a 30° viewing angle.

All patients underwent SJ debridement, tenotomy of the long head of the biceps tendon (as most patients were 60 years of age or older), fascia lata graft harvesting, SCR of the SJ, and subacromial decompression (Fig. 1).

At the end of surgery, all patients were fitted with a soft shoulder brace with a 15° abduction pillow for 6 weeks. During the postoperative period, analgesics were prescribed three times daily and anti-inflammatory drugs once daily at standard therapeutic doses.

Patients completed the Constant Shoulder Score and VAS questionnaires independently. Strength testing with a dynamometer was performed until the onset of pain. All components of the Constant Shoulder Score were supervised by a single physician who had assisted during the surgical procedure.

Statistical analysis was performed using STATISTICA 12.0 by StatSoft, Inc., USA (License No. ALXR712D833252FAN3). Descriptive statistics, including the mean and standard deviation, were used to summarize the baseline characteristics.

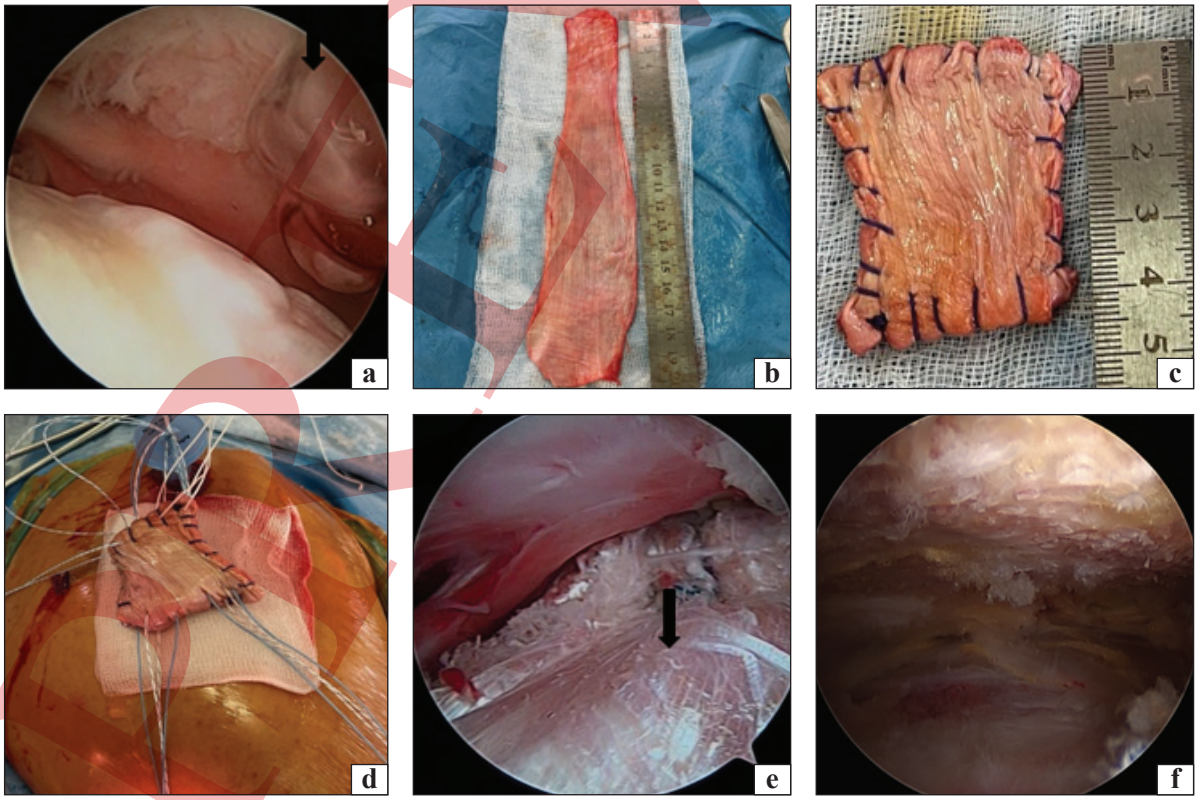


Fig. 1. Stages of the surgical procedure: a) greater tuberosity without the supraspinatus tendon (indicated by an arrow); b) fascia lata graft after harvesting; c) prepared graft for SCR; d) graft sutured to the anchor sutures; e) graft inserted into the joint and fixed to the anchors (indicated by an arrow); f) acromion after plasty.

Results

Table 2 presents the assessment of SJ function according to the Constant Shoulder Score in both groups (mean score) before surgery and at 6 and 12 months postoperatively.

Before treatment, the mean SJ function scores were similar in both groups (p = 0.046), ranging from 44 to 49 points (difference between the healthy and affected SJ). At 6 months postoperatively, the mean functional outcome in Group 2 (eight-layer graft) was (18.5 ± 16.2) points, compared with 20.5 ± 6.9 points in Group 1 (p = 0.037). At 12 months postoperatively, the mean Constant Shoulder Score was (16.6 ± 5.9) points in Group 1 and 12.9 ± 9.1 points in Group 2 (p = 0.022).

The VAS results are presented in Table 3. Before treatment, the mean pain scores in Groups 1 and 2 differed only slightly, ranging from 5 to 6 points. At 6 months postoperatively, the mean VAS score in Group 2 was also better than in Group 1 (p = 0.021), reaching (2.51 ± 1.1) points, whereas the mean pain score in Group 1 was slightly higher at 3.1 ± 1.7 points. At 12 months postoperatively, mean pain scores had decreased substantially in both groups compared with the preoperative values; however, the mean VAS score remained better in Group 2 than in Group 1 (p = 0.05).

Thus, patients in Group 2 demonstrated better mean functional outcomes according to both the Constant Shoulder Score and the VAS at both 6 and 12 months after surgery.

The mean short-term outcomes (6–12 months) following SCR of the shoulder joint were better than the preoperative values in both groups, regardless of the thickness of the fascia lata graft.

Discussion

Treatment of rotator cuff arthropathy of the SJ remains a challenging and unresolved issue, making it difficult to determine the optimal treatment strategy for each stage of this condition. Until recently, these patients were treated with either hemiarthroplasty using a large-head implant or reverse shoulder arthroplasty (Fig. 2). However, this surgical approach is not always justified in younger patients, prompting researchers to develop new surgical techniques, including SCR.

SCR of the SJ is one of the newer treatment options for rotator cuff arthropathy. Since the primary indication for SCR is the absence of fatty degeneration of the infraspinatus and subscapularis muscles, when the force balance between the external and internal rotators is only minimally disturbed, this procedure is being performed with increasing frequency.

Most authors report that the combined thickness of the superior capsule and the supraspinatus tendon at their insertion on the greater tuberosity ranges from 4.4 to 9.1 mm. Some studies suggest that graft thickness may affect shoulder stability; however, the optimal graft thickness for SCR cannot be determined based solely on anatomical studies.

Table 2

Mean Constant Shoulder Score values in patients of Groups 1 and 2 at different follow-up periods

Follow-up period	Group 1 (points)	Group 2 (points)	p
Before treatment	28.90 ± 25.80	33.78 ± 21	0.046
After surgery: – at 6 months; – at 12 months.	 20.50 ± 6.90 16.60 ± 5.90	 18.50 ± 16.20 12.90 ± 9.10	 0.037 0.022

Table 3

Mean VAS pain scores in patients of Groups 1 and 2 at different follow-up periods

Follow-up period	Group 1 (points)	Group 2 (points)	p
Before treatment	5.83 ± 3.90	5.7 0± 2.91	0.014
After surgery: – at 6 months; – at 12 months.	 3.10 ± 1.70 2.80 ± 1.2	 2.51 ± 1.10 2.10 ± 1.30	 0.021 0.050

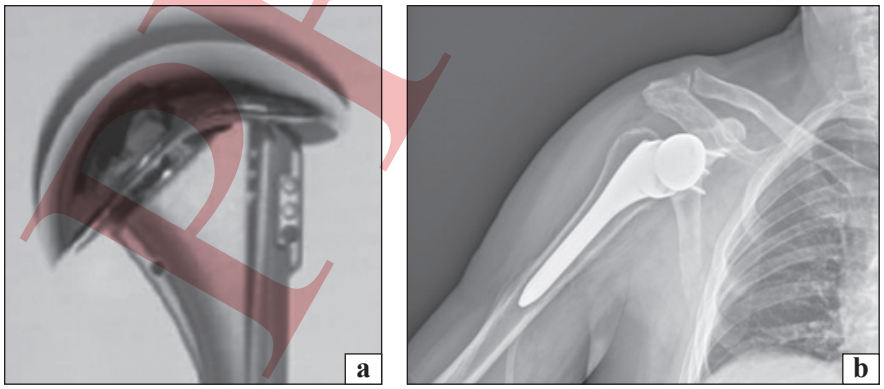


Fig. 2. Appearance of endoprostheses used in patients with rotator cuff arthropathy: a) large-head prosthesis (CTA head shoulder); b) reverse prosthesis.

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Based on our review of the English-language literature, we concluded that comparative studies evaluating different surgical treatment options for early-stage rotator cuff arthropathy of the shoulder joint remain limited.

Most published studies focus on the outcomes of reverse shoulder arthroplasty, the incidence of various complications, and strategies for their management.

In a study by T. Mihata et al. involving eight cadaveric SJs, the authors demonstrated that SCR restores superior stability of the SJ when the graft is fixed with the humerus positioned at either 10° or 30° of abduction. They also reported that an 8-mm-thick fascia lata graft provided greater stability than a 4-mm graft. However, it should be noted that these conclusions were based on cadaveric specimens and therefore did not account for factors such as the condition of the shoulder girdle muscles and the articular cartilage of the SJ.

In their literature review on SCR, R. Dimock et al. concluded that SCR provides good short-term outcomes and that graft thickness influences the results. However, the long-term outcomes of this procedure remain insufficiently studied, as do objective data on graft remodeling and healing. The authors also emphasized that SCR using a fascia lata graft yields better results than the same procedure performed using dermal autografts or allografts.

We also found the study by D. Goutallier et al. of particular interest, as it demonstrated that preoperative assessment of fatty degeneration of the RC muscles is important both for predicting outcomes and for surgical planning. The authors further showed that tears of the subscapularis and infraspinatus tendons require timely repair to achieve satisfactory results following SCR.

In summary, the strengths of our study include the large number of patients with stage II rotator cuff arthropathy who underwent SCR of the SJ and the relatively homogeneous study groups, which allowed for appropriate statistical analysis. The limitations include the short follow-up period (up to 12 months postoperatively) and the lack of objective data, specifically MRI evaluation, on graft remodeling beyond 12 months.

Conclusions

The mean short-term outcomes (6–12 months) according to the Constant Shoulder Score and VAS following SCR of the shoulder joint were better than the preoperative values in patients of both groups, regardless of the thickness of the fascia lata graft.

At 6 months postoperatively, the mean functional outcome according to the Constant Shoulder Score in Group 1 was (20.5 ± 6.9) points, whereas the results in Group 2 were better and amounted to 18.5 ± 16.2 points ($p = 0.037$).

At 12 months postoperatively, the mean functional outcome according to the Constant Shoulder Score in Group 1 was (16.6 ± 5.9) points, whereas in Group 2 it was 12.9 ± 9.1 points ($p = 0.022$).

Conflict of interest. The authors declare no conflict of interest.

Prospects for further research. The authors plan to investigate SCR using the long head of the biceps tendon, as this surgical treatment option is less invasive, and to compare the outcomes of SCR of the shoulder joint using the long head of the biceps tendon, fascia lata, and the semitendinosus tendon from the lower extremity.

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Author contributions. Straphun S. S. — study concept and design; Bohdan S. V. — data collection and processing, analysis of the obtained data, manuscript preparation; Straphun O. S. — data collection and processing; Serhiienko R. O. — systematic analysis of the obtained data.

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RESULTS OF RECONSTRUCTION OF THE UPPER CAPSULE OF THE SHOULDER JOINT WITH THE BROAD FASCIA OF THE THIGH IN PATIENTS WITH ROTATOR CUFF ARTHROPATHY

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