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The effect of time since injury on the progression of rotator cuff arthropathy of the shoulder (retrospective study)

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Rotator cuff disease is a disease of the shoulder joint, which is characterized by insufficient function of the rotator cuff of the shoulder, degenerative changes in the joint capsule and migration (displacement) of the humeral head. The objective of the study is to investigate the influence of time since injury on the progression of rotator cuff arthropathy of the shoulder joint. Materials and methods. We included 91 patients in the study who, at the time of examination, had rotator cuff arthropathy of varying degrees. The age of the patients ranged from 35 to 80 years. The average age was (48.2 ± 19.8) years. The inclusion criteria for the study were as follows: the presence of rotator cuff arthropathy of any degree, clear indication to the patient of the time since the injury, the presence of an MRI scan with a magnetic field strength of 1.5 Tsl, age 35 to 80 years, the absence of concomitant pathology of the shoulder (homarthrosis, calcifying tendinitis and any bone pathology of the proximal epimetaphysis of the humerus. The degree of rotator cuff arthropathy, damage to the soft tissue structures of the shoulder joint, and the time from injury to the patient's visit were determined. Results. The vast majority of patients had stage 2 rotator cuff arthropathy — 60.4 %, a slightly smaller number of patients had stage 1. rotator arthropathy — 23.1 %, patients with 3–5th degree. rotator arthropathy was significantly less — a total of 16.5 %. With an increase in the average terms from the moment of injury, the degree of rotator arthropathy increases. For the development of rotator arthropathy of the 1st degree, an average term of (5.16 ± 1.54) months after injury is required, while for the development of rotator arthropathy of the 4th degree, an average term of (11.25 ± 4.6) months after injury is required. Conclusions. There is a weak (r = 0.31; p = 0.051), but significant dependence of the influence of the term from the moment of injury on the degree of rotator arthropathy. Thus, with an increase in the terms from the moment of injury, the degree of rotator arthropathy of the shoulder joint may also increase.

Ротаторна артропатія — це захворювання плечового суглоба, яке характеризується недостатньою функцією ротаторної манжети плеча, дегенеративними змінами плечового суглоба і міграцією (зміщенням) головки плеча. Мета. Дослідити вплив термінів із моменту травми на прогресування ротаторної артропатії плечового суглоба. Методи. До дослідження включили 91 хворого, які на момент огляду мали діагноз «ротаторна артропатія плечового суглоба» різного ступеня. Вік пацієнтів складав від 35 до 80 років, середній (48,2 ± 19,8) року. Критерії включення до дослідження були наступними: наявність ротаторної артропатії ПС будь-якого ступеня, чітке вказання хворим термінів із моменту травми, наявність МРТ-дослідження з силою магнітного поля 1,5 Тсл, вік 35 до 80 років, відсутність супутньої патології ПС (омартроз, кальцинуючий тендиніт та будь-яка кісткова патологія проксимального епіметафізу плечової кістки. Визначали ступінь ротаторної артропатії, ушкодження м'якотканинних структур плечового суглоба, термін від травми до звернення пацієнта. Результати. Переважна більшість хворих мали 2 ст. ротаторної артропатії — 60,4 %, дещо менша кількість пацієнтів із 1 ст. — 23,1 %, осіб із 3–5 ст. було значно менше — сумарно 16,5 %. Зі збільшенням середніх термінів від моменту травми зростає ступінь ротаторної артропатії, для розвитку 1-го ступеня необхідні середні терміни (5,16 ± 1,54) міс. після травми, тоді як для 4-го — (11,25 ± 4,6) міс. Висновки. Існує слабка (r = 0,31; p = 0,051), але достовірна залежність впливу терміну з моменту травми на ступінь ротаторної артропатії. Отже, зі збільшенням часу із моменту травми може зростати й ступінь ротаторної артропатії плечового суглоба. Дане дослідження потребує продовження для визначення тенденцій прогресування ротаторної артропатії та більш точної статистичної обробки даних хворих з 3–5 ст. захворювання. Ключові слова. Плечовий суглоб, ротаторна манжета плеча, ротаторна артропатія.

Keywords. Shoulder joint, rotator cuff of the shoulder, rotator arthropathy

Introduction

Shoulder joint arthropathy (SJ) is a condition of the joint characterized by insufficient function of the rotator cuff of the shoulder (RCS) due to or as a result of its damage, degenerative changes in the SJ, and migration (displacement) of the humeral head [1–4]. SJ arthropathy in the English-language literature is more often described as the phrase "rotator cuff tear arthropathy" or "cuff tear arthropathy", in the Ukrainian-language literature the expression "rotator arthropathy" is quite often used, which we will continue to use. The tendons of the RCS play a crucial role in the dynamic stabilization of the naturally unstable SJ [1]. Violation of this dynamic stabilization for any reason leads to the development of degenerative changes in the joint, the so-called rotator arthropathy.

The etiology and factors that influence the progression of SJ rotator arthropathy remain poorly studied. It is known from the literature that only 4 % of patients with RCS tendon injuries develop rotator cuff arthropathy [1–4]. In cases of extensive RCS tendon ruptures, the likelihood increases significantly, reaching 50 % or more. However, it is important to note that not all extensive RCS tendon ruptures result in rotator cuff arthropathy, nor does it always lead to its progression [5–7].

According to some data, the timing of RCS injury has an impact on the progression of rotator cuff arthropathy [8–10]. In clinical practice, it is not uncommon to observe patients exhibiting signs of rotator cuff arthropathy without notable progression over several months.

There are very few publications on the impact of the timing of the disease on the progression of rotator cuff arthropathy. That is why most practitioners neglect the possibility of progression of rotator cuff arthropathy, which causes late referral of patients, when the only possible option for surgical treatment is reversible prosthetic replacement of the shoulder joint.

Purpose: to investigate the impact of the timing of injury on the progression of rotator cuff arthropathy of the shoulder joint.

Material and methods

From 2014 to 2024, 1,094 patients with various RCS tendon ruptures were treated at the Clinic of Reconstructive and Restorative Surgery of the Upper Limb of the State Institution "National Institute of Traumatology and Orthopedics of the National Academy of Medical Sciences of Ukraine" (Kyiv). Of these, 433 patients had a supraspinatus tendon rupture (partial or complete), 402 had supraspinatus tendon damage in combination with partial ruptures of the subscapularis (298 cases) and infraspinatus (104 cases). In 259 patients, we observed massive ruptures of the RCS tendons (full-layer ruptures of 2 or more).

We included 91 patients in the study who had rotator cuff arthropathy of varying degrees at the time of examination. The patients' ages ranged from 35 to 80 years. The average age was (48.2 ± 19.8) years. Table 1 shows the distribution of the study group by age and sex. All the patients were examined clinically and radiographically before the start of treatment. Direct projection radiography of the shoulder was performed (Fig. 1) to determine the degree of rotator cuff arthropathy according to Hamada [1, 7]. The normal value of the acromio-humeral interval was considered to be 8–12 mm [11–13]. All the patients also underwent MRI of the anatomical structures of the shoulder, including the tendons and muscles of the RCS in T1, T2, Pd and Pdfatsat modes. The degree of rotator cuff arthropathy, damage to the soft tissue structures of the shoulder, and the time from injury to treatment were determined.

The inclusion criteria for the study were as follows: the presence of rotator cuff arthropathy of any degree, clear indication of the patient's time from the moment of injury, the presence of MRI with a magnetic field strength of 1.5 Tsl, age from 35 to 80 years, the absence of concomitant disorders of the shoulder (homarthrosis, calcifying tendinitis and any bone condition of the proximal epimetaphysis of the humerus).

Statistical data processing was carried out using the STATISTICA 12.0 software by StatSoft, Inc. of USA (license No. ALXR712D833252FAN3). Descriptive statistics methods were used, the data were presented as the sample mean and its standard deviation (M ± SD) under normal distribution conditions and as the median and quartiles (Me [25Q–75Q]) in the case of a distribution other than normal.

Table 1

Distribution of the study group by age and gender

Age (years)	Gender, (%)		p*
	male	female	
35–45	0	4	—
46–60	10	24	0.084
61–80	14	39	0.033
Total	24	67	0.026

Note. * — Mann-Whitney criterion.

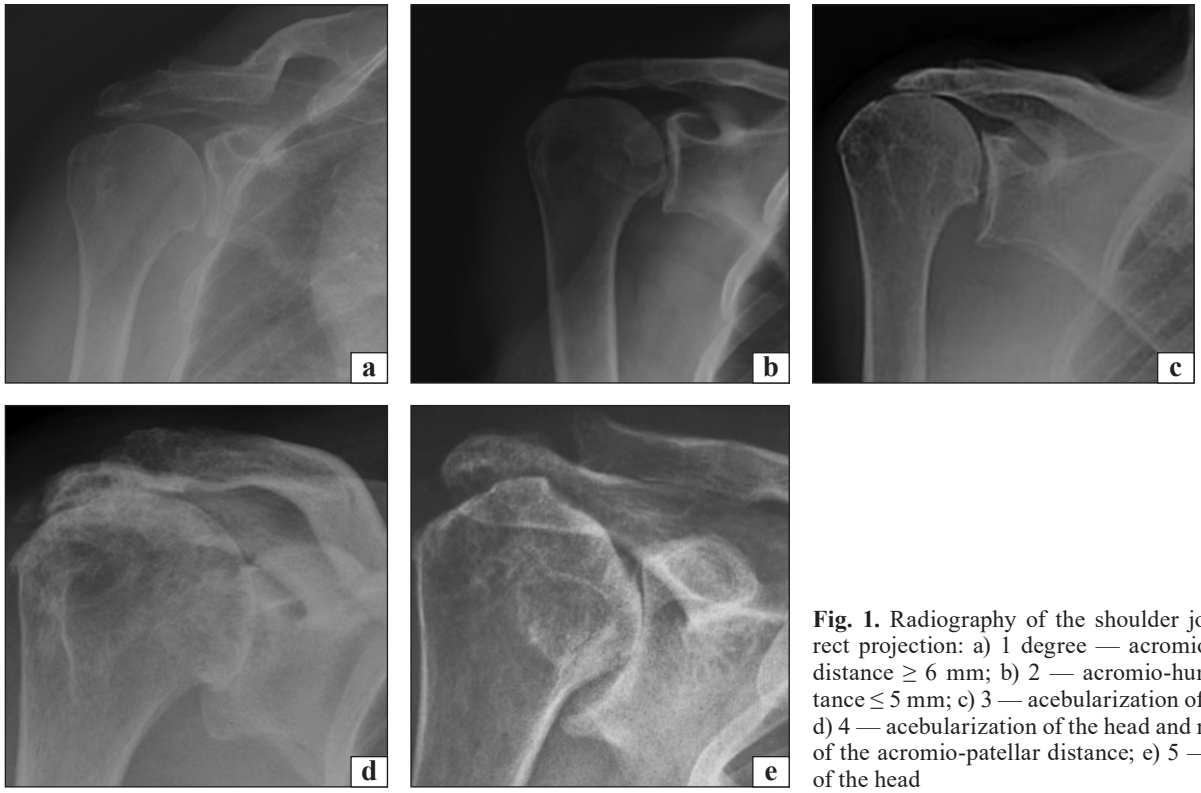

Fig. 1. Radiography of the shoulder joint in direct projection: a) 1 degree — acromio-humeral distance ≥ 6 mm; b) 2 — acromio-humeral distance ≤ 5 mm; c) 3 — acebularization of the head; d) 4 — acebularization of the head and narrowing of the acromio-patellar distance; e) 5 — collapse of the head

To compare the results, we used the Student's t-test (for two groups under normal distribution of indicators) and the Mann-Whitney test (for two or more groups during the analysis of indicators that demonstrated a distribution other than normal). The differences in the distribution of the two samples were assessed using the χ^2 test. Quantitative data are presented as n (%). The calculation (M ± SD) under nonparametric distribution of values was used to compare the results we obtained. Differences between indicators were considered significant at $p < 0.05$.

Results

Table 2 shows the distribution of patients by degree of rotator cuff arthropathy according to radiographic examination. The majority of patients were diagnosed with stage 2, comprising 60.4 % of the cases. A smaller proportion, 23.1 %, were in stage 1, while stages 3 to 5 accounted for a total of 16.5 %.

Table 3 shows the average time from injury to diagnosis for each degree of rotator arthropathy. The degree of rotator arthropathy tends to increase with the average time from injury. For the development of stage 1, the average time (5.16 ± 1.54) months after injury is required, while for stage 4, it is (11.25 ± 4.6) months. However, this trend is not observed in all cases. The average rates of development of stage 5 rotator arthropathy may appear earlier than stage 4. This is likely attributable to the influence of additional factors that require further investigation. To clarify the influence of time from injury on the degree of rotator arthropathy, we conducted a correlation analysis, taking into account the indicators of each patient (Fig. 2).

Table 2

Distribution of patients by degree of rotator cuff arthropathy according to radiographic examination

Degree of rotator cuff arthropathy	Number of patients, (%)
1	21 (23.1)
2	55 (60.4)
3	8 (8.8)
4	4 (4.4)
5	3 (3.3)

Table 3

Average time from injury to diagnosis for each degree of rotator cuff arthropathy

Degree	Average duration of the disease, (months)
1	5.01 ± 1.71
2	6.35 ± 3.5
3	7.56 ± 2.37
4	11.25 ± 4.6
5	10.70 ± 6.03

Notes: Results are presented as (M ± SD); where M is the mean value of the indicator in the group, SD is the standard deviation.

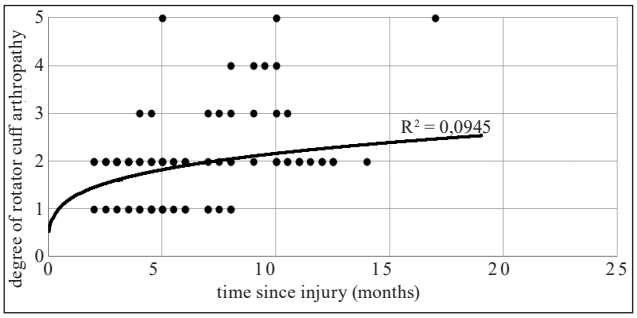

Fig. 2. The influence of time since injury on the degree of rotator cuff arthropathy of the shoulder joint

As can be seen from Fig. 2, there is a weak (r = 0.31; p = 0.051), but significant dependence of the influence of the time since the injury on the degree of rotator arthropathy. As time progresses following the injury, the severity of rotator arthropathy is likely to increase.

Discussion

The influence of the time since the injury on the progression of RCS tendon rupture is widely discussed in the literature [11, 14–16]. Most authors note that stable RCS tendon ruptures do not increase with time, progressive ones tend to increase. At the same time, the number of progressive ruptures is significantly greater than the number of stable ones [13–16]. In conclusion, we note that we can observe massive RCS tendon ruptures even without their traumatic damage.

A. Bedi et al. divide RCS tendon ruptures into those with pain syndrome and so-called asymptomatic ones. The study conducted by the authors using an ultrasound device showed that in 49 % of patients with an asymptomatic course of the disease, the size of the rupture increases by 5 mm or more in an average period of 2.8 years. In 46 % of patients who had an asymptomatic course of the disease, pain syndrome appeared in an average period of 2.6 years. The risks of increasing full-thickness RCS tendon ruptures were significantly greater than partial ruptures and were 26, 58 and 80 % after 2, 5 and 8 years, respectively [16]. In this study, the authors identified risks for the progression of RCS tendon rupture, including the patient's age, time since diagnosis, the nature of tendon damage (full-thickness or partial rupture), and the location of the rupture.

A somewhat similar study was conducted by C. A. Kwong et al., in which they identified a large number of patients with progression of full-thickness RCS tendon ruptures over a period of 3 years or more and recommended arthroscopic suture of RCS tendons to prevent progression of damage [17]. The authors did not pay sufficient attention to the study of factors that influence the progression of RCS tendon ruptures.

There is a limited body of literature on the progression of knee arthropathy and the factors that influence its development. This is primarily since patients at the time of referral have severe pain syndrome, contracture of the knee and require treatment, which is mainly surgical. Therefore, most of the literature sources relate to reversible knee prosthesis, which is the most effective in the treatment of this group of patients [11, 14]. Given the impossibility of long-term observation of patients, statistical analysis methods are optimal in these cases.

Our study results show that the time since the injury has a negligible effect on the progression of rotator cuff arthropathy. This may be due to the short observation period (up to 2 years), or it may be due to other factors: the size of the RCS tendon rupture, the presence of damage or medial dislocation of the long head of the biceps tendon.

In the study of R. Furuhata et al. analyzed the displacement of the humeral head by 21° of the SJ, which revealed that ruptures of the tendons of the infraspinatus muscle and the long head of the biceps play the main role in the migration of the humeral head cranially, and in the case of damage to the subscapularis muscle and the long head of the biceps, there is a decrease in the distance between the shoulder and the scapula, i.e. the articular cartilage of the SJ [18].

A promising direction of our research is the study of the following factors: age, gender, combination and magnitude of rupture of the tendons of the RCS and other structures of the SJ on the progression of rotator arthropathy.

Conclusions

There is a weak (r = 0.31; p = 0.051), but significant dependence of the influence of the period since the injury on the degree of rotator arthropathy.

The severity of rotator arthropathy of the SJ may increase with the time elapsed since the injury.

This study needs to be continued to determine the trends in the progression of rotator arthropathy and more accurate statistical processing of data from patients with 3–5 stages of this disease.

Conflict of interest. The author declares the absence of a conflict of interest.

Prospects for further research. A promising direction of our research is the study of other factors, such as age, gender, combination and magnitude of rupture of the tendons of the RCS and other structures of the SJ on the progression of rotator arthropathy. In addition, it is necessary to continue the study of patients with 3rd, 4th, and 5th degree rotator cuff arthropathy to increase the statistical significance of our study.

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Author's contribution. Bogdan S. V. — collection and processing of materials, analysis of the obtained data, drafting the article.

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THE EFFECT OF TIME SINCE INJURY ON THE PROGRESSION OF ROTATOR CUFF ARTHROPATHY OF THE SHOULDER (RETROSPECTIVE STUDY)

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