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ANALYSIS OF THE RESULTS OF SURGICAL TREATMENT OF DISTAL BICEPS TENDON RUPTURE

АНАЛІЗ РЕЗУЛЬТАТІВ ХІРУРГІЧНОГО ЛІКУВАННЯ РОЗРИВІВ ДИСТАЛЬНОГО СУХОЖИЛКА БІЦЕПСА ПЛЕЧА

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Abstract. *The main problems associated with the surgical treatment of distal biceps tendon rupture were analyzed in this study. The aim of this study was to compare two methods of surgical treatment of distal biceps tendon rupture. The technique of surgical intervention with using a cortical button fixator and its key steps are described in detail. The functional outcome of the treatment was assessed using the DASH scale. The results were processed using statistical data analysis. The advantages and disadvantages of this method over similar methods and its role in the surgical treatment of this pathology were determined.*

Key words: *Tendon injury, biceps tendon, refixation, surgical treatment.*

Frequency of the distal biceps tendon rupture is 1.2 - 1.25 per 100,000 patients annually. The percentage of men among patients is 86-100% according to different data. According to the different authors, the average age of a patient varies from 42.5 to 47 years. The injury of the dominant limb according to the research data varies from 57.69% to 86%, but there are no studies that reliably confirm a clear correlation at the moment. It has been proved that the key factor in the emergence of this pathology is degenerative-dystrophic damage of the injury site. High-energy injuries are the etiological factor only in 9.6% of cases. The influence of smoking on the frequency of this injury has also been proved. Marc R. Safran and Scott M. Graham found that smokers have a 7.5-fold higher risk of the distal biceps' tendon rupture.

Since the majority of patients with distal biceps tendon rupture are men of working age, an important aspect in the choice of treatment tactics is the rehabilitation period with the possibility of early return to professional activity and functional outcome. Therefore, conservative treatment is inexpedient in most cases. Conservative management of this category of patients lead to significantly increased treatment time and disability period, and the function can be restored only partially. Bending in the elbow joint remains weakened, especially in case of supine forearm. Therefore, the method of choice is tendon refixation to the anatomical attachment site.

In general, there are several methods of distal biceps tendon refixation. Today the main tendencies in surgical treatment of this nosology are: anchor fixation to radial tuberosity; fixation of biceps distal tendon with oval-shape cortical button.

In spite of the fact that there are several similar methods of treatment of this nosology, the scientific search for their improvement and invention of new methods

continues. The aim of the study is to reduce the number of complications, shorten the rehabilitation period, improve the functional results, and so on. Typical complications that arise after surgical treatment include anchor tear-off, tendon re-rupture, heterotopic ossification, and skin branch of the musculocutaneous nerve neuropathy.

There are several methods of fixation the distal biceps tendon with anchors. A new and promising method is anchor fixation to radial tuberosity on the opposite side of the bicep's attachment point. Another modern method of surgical treatment is fixation of biceps distal tendon with oval-shape cortical button. The effectiveness of this method of fixation has been recognized by the world community and proved by scientific research. Also, this method is successfully used in case of other injuries of musculoskeletal system elements. For example, in case of acromioclavicular joint rupture (both for open surgery and arthroscopic technique), fractures of distal clavicle, damage of distal tibiofibular syndesmosis, tendon rupture of greater pectoralis muscle.

Aim

The aim of the study was to carry out a comparative analysis of surgical treatment of distal biceps tendon rupture with anchor fixation and fixation with an oval-shaped cortical button.

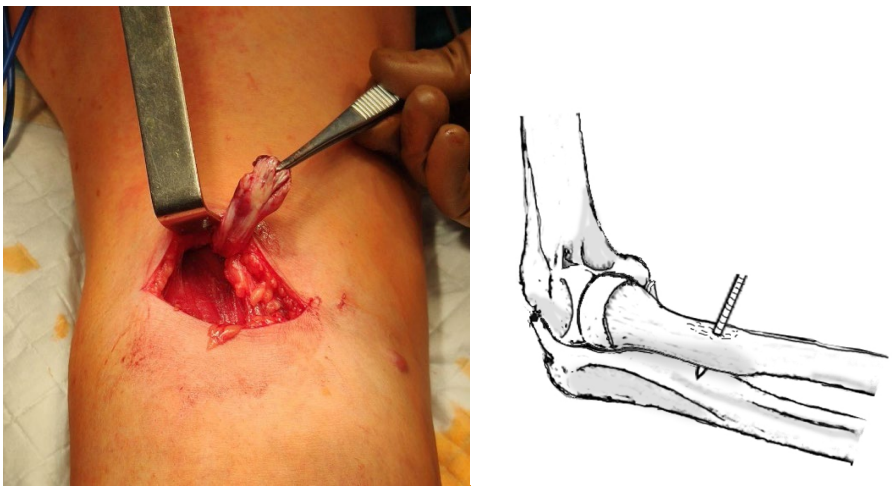
Materials and methods.

In the period from 2017 to 2020, 29 patients with distal biceps tendon rupture were treated at the Traumatology Department of Zaporizhzhya Regional Clinical Hospital. 27 patients (93.1%) were men. The average age was 45.5 years (from 34 to 57 years).

The diagnosis of distal biceps tendon rupture was established clinically: based on complaints of pain in the distal third of the brachii and elbow joint, increased by movement in the elbow joint; subjective reduction of the forearm flexion force; based on the antecedent history (acute pain during forearm extension under the influence of weight or lifting of the weight with forearm flexion, in some cases, patients noticed a sound like a crunch); based on objective examination – palpation of the shortened biceps muscle in the middle to upper third of the brachii; positive "hook- test" (in the normal course of active forearm flexion to 90 º with the tension of the biceps muscle under its tendon, the researcher is able hook with index finger), the presence of tissue wasting at the site of biceps attachment. The diagnosis of distal biceps tendon rupture is confirmed by X-ray examination of the elbow joint in 2 projections (no radiological injuries) and ultrasound investigation of soft tissues in the elbow joint area (ultrasound signs of partial damage or complete rupture of the distal biceps tendon).

Patients were divided into two groups: 1) 13 patients were operated on by anchor fixation; 2) 16 patients were operated by the method of fixation with an oval-shaped cortical button.

The surgical intervention in the first group of patients was carried out according to the standard method. Surgery with an oval-shaped cortical button was performed according to the author's method. Access along the front surface of the upper limb in the elbow fossa (slightly below the biceps muscle). Incision was performed to the injury site with the following extraction of distal biceps tendon (Fig.1a).

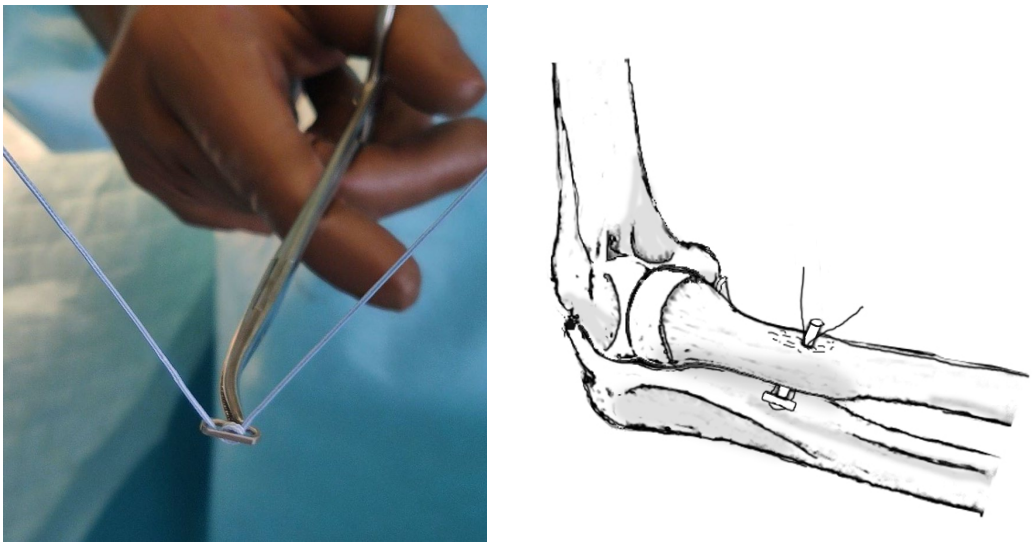


a) b)

Fig. 1. A - operative approach and stump of distal biceps tendon; b - formation of the channel through both cortical layers.

Author's development

The next step is formation of the channel through both cortical layers (Fig.1b) of radius bone and carrying out of oval-shaped cortical button with strong non-resorbable suture material to the opposite surface of radius bone (Fig.2a). Turn the oval-shaped cortical button by dosed traction for one of the threads and hold the fixer on the bone surface by dosed ligature tension (Fig.2a).



a) b)

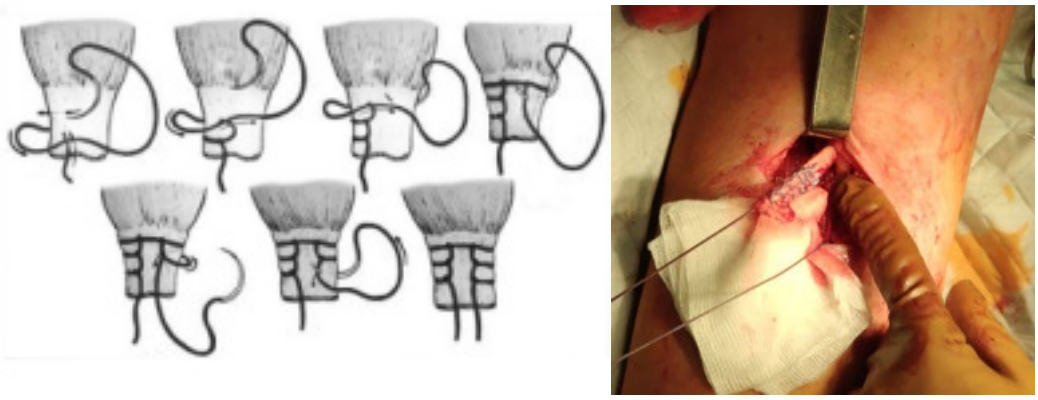
Fig. 2. a – oval-shaped cortical button with a drawn thread; c - oval-shaped cortical button with non-resorbable suture material after positioning on the bone.

Author's development

After that the surgeon takes one of the ligatures and sews the distal biceps tendon with a tendon suture (Fig. 3a). First, it is sewn in proximal direction, and then, moving to the opposite side of tendon - in distal direction (Fig. 3a,b).

Applying a traction by the free end of ligature tight contact of biceps distal tendon stump with its attachment place is achieved (Fig. 4a, b). Extending the

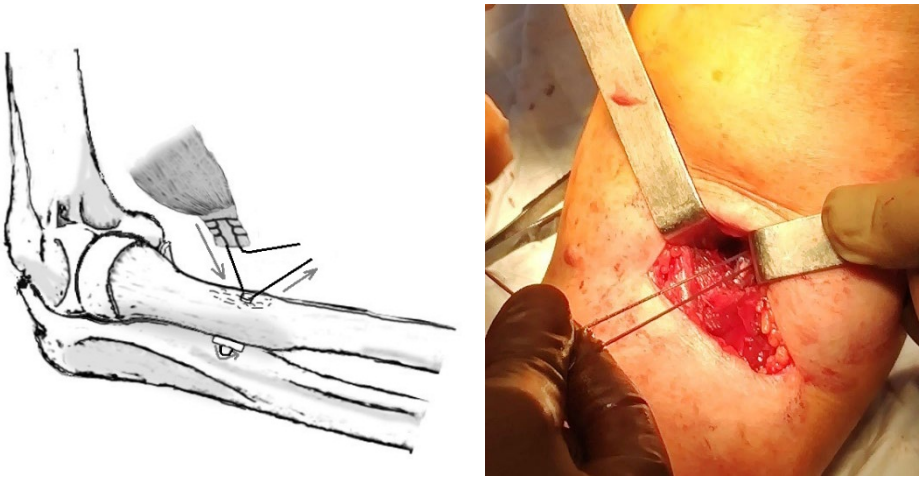
traction, ligature is binding and checking the oval-shaped cortical button position by fluoroscope (Fig. 5a, b). Additionally, the biceps tendon is sewing with the free ends of ligatures. The wound is bathed with aseptic solutions and closed in layers.



a) b)

Fig. 3. a – biceps tendon sews with a special suture; b – threaded with synthetic thread distal biceps tendon stump.

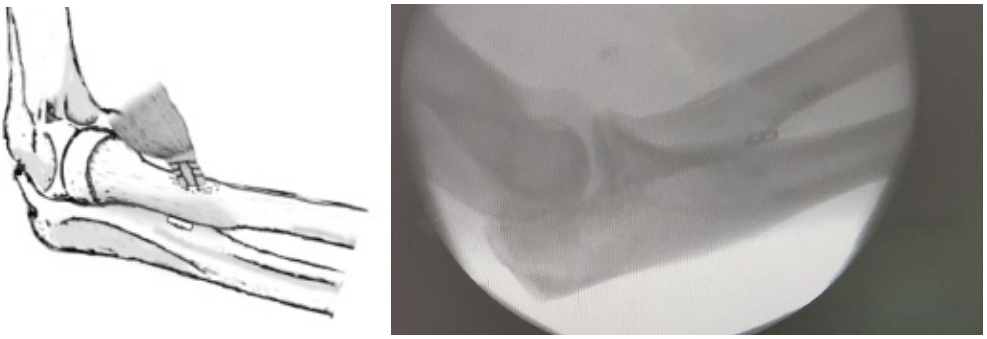
Author's development



a) b)

Fig. 4. a – traction for the free end of ligature; b - surgical wound after traction for free end of ligature and tendon stump anatomical insertion place achievement.

Author's development



a) b)

Fig. 5. a – refixed to the anatomical insertion place biceps tendon; b - checkup of oval-shaped cortical button with fluoroscope.

Author's development

Evaluation of the results was carried out with the DASH scale in 2 weeks, 2 and 12th months after the surgery. The main section of the questionnaire consists of 30 questions about hand function in the last week. 21 points reveal difficulties in performing various physical actions because of limitation of arm or hand function; 6 points concern the severity of some symptoms and 3 - social role functions. Each point has 5 answer options, evaluated in points from 1 to 5. The sum of points for all points is then turned into a 100-point scale. Thus, DASH evaluates life activity limitations because of the upper extremity dysfunction from 0 - no limitation (good functionality) to 100 - excessive limitation.

Statistical processing of the obtained numerical value was carried out with a computer and license packages Office Excel 2010 and Statistica 6.0. Methods of non-parametric variation statistics were used in the analysis process. Manna-Whitney U-criterion was used to evaluate differences in research and comparison groups. The differences between the mean values were considered reliable if the value of $p \leq 0.05$.

Results

All surgical interventions were performed within 3-7 days after the injury. There were not revealed any complications in early postoperative period. The evaluation according to DASH scale in the group of anchor and oval-shaped cortical button fixation at the moment of patient's encounter was 76.8 ± 7.16 and 74.3.1 ± 6.44 respectively.

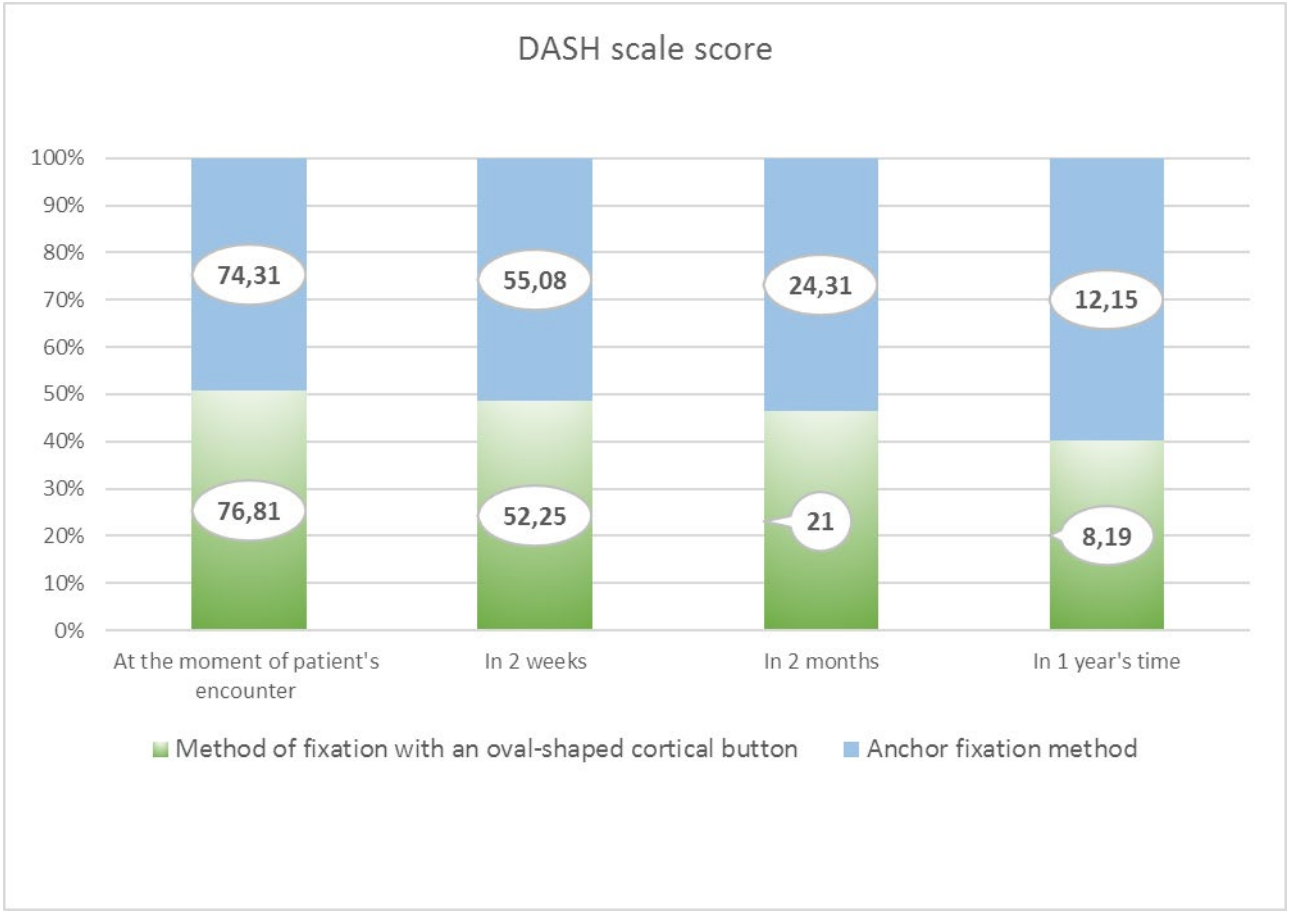


Fig. 6. DASH assessment at the time of treatment and after the operation in 2 weeks, 2 months and 1 year.

Author's development

The next assessment was made in 13-15 days after the surgical intervention. The evaluation by groups was 55.08 ± 5.81 and 52.25 ± 7.38 respectively. At the control examination performed 2 months after surgery, the estimate in the anchor group was 24.32±5.31, that is ~3.32 more than in the oval-shaped cortical button group (21.0±6.12). One year after the surgery, the DASH score was 12.15 ± 4.41 and 8.19 ± 5.5 respectively in both study groups (Fig. 6).

There were 2 complications in the first group (15.4% of the total): 1 case of heterotopic ossification and 1 case of anchor tear-off (7.7% of the total number respectively). In the second group there was 1 case of heterotopic ossification (6.25% of the total).

Table 1.

Complications of surgical treatment of distal biceps tendon rupture.

	Group 1	Group 2
Heterotopic ossification	1 (7.7%)	1 (6.25%)
Re-rupture	1 (7.7%)	0 (0%)

Author's development

In case of the anchor tear-off re-surgery is required. The distal biceps tendon must be re-fixed at the anatomical insertion place. All heterotopic ossification cases were treated conservatively with the NSAIDs and rehabilitation therapy. Septic complications were not observed in either study group.

Discussion

The data obtained demostarte good functional results in both groups: with the anchoring method and with the use of a method of oval-shaped cortical button fixation. Patients in both groups were assessed for functional results on the DASH scale on all control examinations. Analysis of the results using a computer and the Office Excel 2010 and Statistica 6.0 licence packages showed that the difference was statistically insignificant. At the same time, all patients returned with satisfactory functional results and at the time of the final check-up there were virtually no restrictions in everyday life associated with the affected upper limb. In the course of the study, however, complications occurred in three patients. There were two complications in the group of patients operated on with the method of anchor fixation - one case of heterotopic ossification (treatment was conservative) and one case of Re-rupture. In the case of Re-rupture, repeated re-surgery was required. One case of heterotopic ossification occurred in a group of patients operated with the cortical button fixation method. Treatment was carried out conservatively. Surgical treatment with the cortical-button fixation method was accompanied by less soft tissue injury, and one small surgical access was required for this method. Surgical intervention took less time.

Conclusions

1. The comparative analysis of the results of surgical treatment of patients with distal biceps tendon rupture demonstrated reliability and good functional outcome as a method of anchor fixation and as a method of oval-shaped cortical button fixation.

2. Statistical analysis of the data demonstrated that there was no significant difference in functional outcome in the early and distant postoperative period in both

groups.

3. Surgical treatment with oval-shaped cortical button method is accompanied by less traumatic of the surrounding tissues, short surgical approach, short time of surgical intervention. These factors have a positive impact on the early postoperative period.

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Анотація. *В даному дослідженні проаналізовані основні проблеми пов'язані з хірургічним лікуванням розриву дистального сухожилка біцепса двоголового м'яза. Метою даного дослідження було порівняти два методи оперативного лікування розриву дистального сухожилка двоголового м'яза плеча. Детально описана методика оперативного втручання з використанням кортикального гудзикового фіксатора і його ключові етапи. В даному дослідженні була здійснена оцінка функціонального результату лікування за допомогою шкали DASH. Отримані результати були оброблені за допомогою статистичного аналізу даних. Визначено переваги та недоліки зазначеного методу щодо аналогічних, його роль в хірургічному лікуванні розриву дистального сухожилка біцепса.*

Ключові слова: *пошкодження сухожилка, сухожилля біцепса, рефіксація, оперативне лікування.*

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