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Neglected injuries of the muscles of the upper arm and rotator cuff: a case of myofascial transposition

O.A. Kaplunov[1,2]✉, S.A. Demkin[2], K.F. Abdullaev[2], K.O. Kaplunov[1], A.A. Malyakina[1,2]

[1] Volgograd State Medical University, Volgograd, Russian Federation
[2] Multidisciplinary Medical Center, Volgograd, Russian Federation

Corresponding author: Oleg A. Kaplunov, volortho@mail.ru

Abstract

Introduction A case of a successful surgical treatment of a neglected injury of the upper arm muscles and rotator cuff in a working-age man with a history of an episode of thromboembolism of small branches of the pulmonary artery is presented. **The aim** of this study was to demonstrate one of the approaches to surgical treatment of this pathology that resulted in the improvement of upper limb function and the quality of life of the patient. **Material and methods** A comprehensive study of the patient's outpatient and inpatient records, results of clinical, instrumental and laboratory methods, the types of intervention and rehabilitation along with medical prevention of thrombosis are described in detail. **Results** Eight months after the surgery, there was an improvement in the function of the right shoulder joint. The range of active motion significantly increased; the DASH score decreased from 136 to 52 points; pain decreased from 46 to 31 points according to VAS; the level of self-service significantly improved. **Discussion** Combined techniques of preserved muscle transposition to replace the lost function of the damaged ones was a condition and a guarantee of the achieving significant progress in the anatomical and functional status of the patient. Nevertheless, a further search for more rational technologies for restorative reconstruction in the disorders under consideration seems appropriate. **Conclusion** A correctly chosen and based on clinical and instrumental data transposition of the tendons of the active muscles of the shoulder joint area to replace the lost shoulder antagonists provides improvement of the upper arm function and patients' quality of life while the justified tactics of thromboprophylaxis allows control of hemostasis and absence of vascular failures.

Keywords: neglected injury, paresis, upper arm muscles, rotator cuff, shoulder, myofascial transposition

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INTRODUCTION

A brachial plexus injury, one of most serious among musculoskeletal injuries is associated with muscle palsy and accounts for 2–3.7 % of all trauma cases [1–3]. Palsy of the shoulder girdle and rotator cuff muscles are accompanied by a significantly decreased function of the shoulder joint. The injury to the dominant side leads to a significantly decreased quality of life [4, 5]. Treatment of a brachial plexus injury has a medical and social role with the prevalence of persons of working age among the affected and a disability rate over 80 % [6, 7].

Muscle weakness and neglected injury poses difficulties in identifying a promising treatment strategy. Dysfunction of the deltoid muscle and the rotator cuff causes a significantly limited range of active motion and destabilizes the segment with subacromial dislocation. Treatment of the pathology requires technically complicated, multi-stage operations and long-term rehabilitation [8, 9]. Brachial plexus injuries are normally treated by neurologists and neurosurgeons, and orthopaedic suregons are rarely involved in the treatment of the condition. Nevertheless, reconstructive interventions have been developed since the beginning of the 20th century to repair tendons, muscles and bones of the shoulder girdle to compensate for emerging disorders. Indications to the procedure is a very important issue, and conservative therapy can be effective for unspecified residual preservation of nerve trunks, and failed reconstruction would suspend recovery.

Radiography, MRI/CT scanning of the shoulder joint and ENMG of the upper limb can be produced in addition to physical examination for identifying strategy in favor of tendon and muscle reconstruction. Major vessels are to be investigated. Electrophysiological findings are the main criterion with absent axillary and suprascapular nerve conduction, and rehabilitation can be associated solely with orthopaedic care. The time elapsed from injury also matters. Surgical intervention can be considered after 4–6 months of ineffective conservative therapy [2].

Two goals can be pursued with reconstructive treatment. The first is to regain balance of muscle "drivers" with the humeral head centered in the glenoid affected by weakness of the rotator cuff that is often lateralized in the subacromial space. The second aims to replace the shoulder abduction function lost due to deltoid injury, and the anterior and posterior deviation. The latter can be achieved with transfer of the trapezius insertion first described by L. Mayer (Fig. 1 a, b, c) who used a fascia lata graft [10–12]. The technique was modified by Bateman (Fig. 1d), and further by Saha.

The first produced a split of the scapula, the acromial end of the clavicle, the acromial process at the insertion and bone fixation at the humerus tuberosity. However, the procedure showed poor results without centering the humeral head back. Saha suggested transfer of m. latissimus dorsi (or m. teres major) to the lesser tubercle improving the procedure due to the centering and stabilization of the head in the glenoid [13, 14].

The purpose of the study was to demonstrate one of combined approaches to surgical treatment of the pathology resulting in improved function of the upper limb and quality of life.

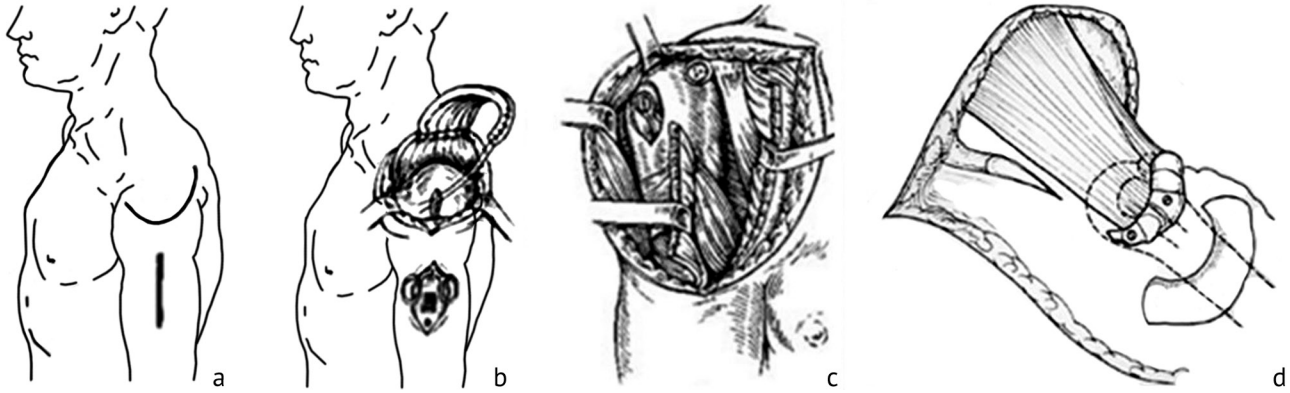

Fig. 1 Transfer of the trapezius insertion as described by Mayer (a, b, c) and modified by Bateman (d)

MATERIAL AND METHODS

The paper presents a clinical case of the treatment of a 60-year-old patient T. who sustained polytrauma with multiple fractures of the lower limbs, blunt trauma of the chest organs, thromboembolism of small branches of the pulmonary artery, traction neuropathy of the suprascapular and axillary nerves and palsy of innervated muscles in March 2019. Treatment of injured muscles of the shoulder girdle muscles and the rotator cuff on the right was delayed due to the severity and emergency management of other injuries. The patient received two courses of rehabilitation including physiotherapy, massage of the affected shoulder girdle, physical therapy of the joint and pharmaceutical support based on the recommendations from neurologists without obvious effect. The patient developed significantly restricted range of active movements in the right shoulder joint and moderate pain at 6 months. Preoperative ROM (according to Marx) was 7–10 flexion, extension and abduction (with a decrease in muscle strength to 0.5–1 points (Fig. 2)). A photo shows the patient attempts to raise both limbs.

The function of the upper limb scored 136 points on the DASH scale, the VAS score was 46 points. CT scan and ultrasound examination (MRI could not be indicated with metal constructs in the femur and tibia) showed complete tear of the tendons of the scapular, supraspinatus, infraspinatus and lesser teres muscles and atrophy Goutallier grade 3–4 degrees, dislocation of the humerus head upward, narrowing of the subacromial space of 2 mm and outward, a gap between the shoulder head and the articular process of the scapula of 1.5 cm and destabilized joint. ENMG indicated severely decreased conduction of the suprascapular and axillary nerves. There was an irretrievable loss of major antagonist muscles that provided movement in the shoulder joint, and shoulder function could be improved by tendon transfer of the preserved muscles. Transfer of a portion of the trapezius muscle to the insertion of the paretic deltoid and the tendon of the latissimus dorsi to the lesser tubercle of the humerus created conditions for the balance of forces to be restored at the point of rotation of the humerus head. The combined Mayer-Bateman method and bone fixation was employed for mobilization of the trapezius muscle performed by two teams of surgeons to reduce the operating time, blood loss and other risks.

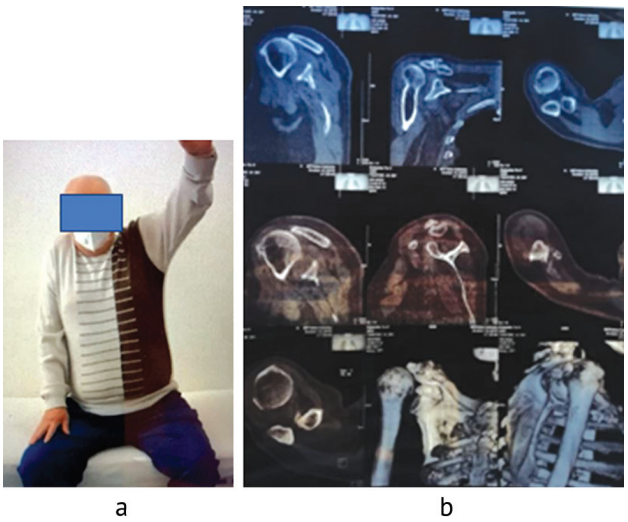

Fig. 2 Patient trying to perform active movements (a) and CT findings (b)

On 12.05.2020, one surgical team performed transfer of a portion of the tendon of the trapezius muscle to the deltoid insertion on the shoulder tuberosity and another team produced transfer of the tendon of the latissimus dorsi to the lesser tubercle of the right humerus using two approaches. The patient was positioned on a side on the operating table. Access to the distal portion of the trapezius muscle was performed through the "epaulettes" incision and extended laterally and distally from the top of the "epaulette" (Fig. 3a). The tubercle of the shoulder head and the deltoid insertion were "obtusely and acutely" mobilized on the lateral aspect of the segment. A significant distal portion of the tendon of M. trapezius was taken with bone fragments of the acromial end of the clavicle, acromion and the spine of the scapula, mobilized and stitched to the tuberosity of the right humerus with the shoulder abducted at 90 using transossal suture (according to the Saha technique).

A S-shaped incision was made along the lateral aspect of the scapula (Fig. 3b). The tendon of the latissimus dorsi was isolated, cut off the insertion (Fig. 3c) and was lengthened by 5 cm using a fragment of the fascia lata of the right thigh and fixed to the lesser tubercle of the right humerus with transossal sutures. The wounds were sutured in layers over vacuum drains. The right upper limb was immobilized using an abduction splint at 30º abduction and 30º flexion for 6 weeks. Individual rehabilitation divided into three periods of early, late postoperative and recovery started after three postoperative days. Early period (corresponding to the period of immobilization) included relaxation exercises for smaller and medium muscles, calisthenics for healthy joints and muscle groups and those for maintaining a full ROM in the wrist joint of the injured upper limb. Rehabilitation tools of the late postoperative period (3 weeks after the removal of the orthosis) were expanded to include active-passive movements in the shoulder joint, assisted pendulum exercises, isometric, isotonic and rhythmic stabilization exercises, massage of the upper limbs, magnetic therapy, kinesiotaping. The recovery period (10 weeks to 6 months) included the PNF technique, postisometric and postreciprocal relaxation, active movements in the operated joint to achieve the maximum possible ROM using the upper limb weight, a rubber shock absorber and weights up to 3 kg, stretching exercises for the shoulder muscles to improve the scapulohumeral rhythm, coordinated movements, dynamic stereotype, to maintain scapular function and the mobilization. The movements were performed in all planes and based on pain sensations.

Considering severe hemostatic complications of the injury and surgical treatment the patient received, thromboprophylaxis played the role in the case. Thromboembolism of small branches of the pulmonary artery that developed during the emergency stage was treated with LMH injected in the form of Russian generic analogues of enoxaparin. Abundant serous hemorrhagic discharge from wounds was observed after 4-day treatment, and an adverse reaction in the form of GIT was diagnosed with decreased platelet count below 70×10^9/l. LMH was replaced with fondaparinux, followed by a transfer to titrated warfarin administration for 3 months. At the patient's request and the anamnestic information, the volume of the upcoming surgical intervention assessed and the NOAC available on the pharmaceutical market thromboprophylaxis was administered with rivaroxaban 10 mg, i.e. in a preventive dosage. The decision was a compromise of two factors including the lack of clinical recommendations on prevention of thrombosis during upper limb surgeries and PE of small branches developed six months later. The duration of the NOAC administration corresponded to the period of immobilization of the operated limb.

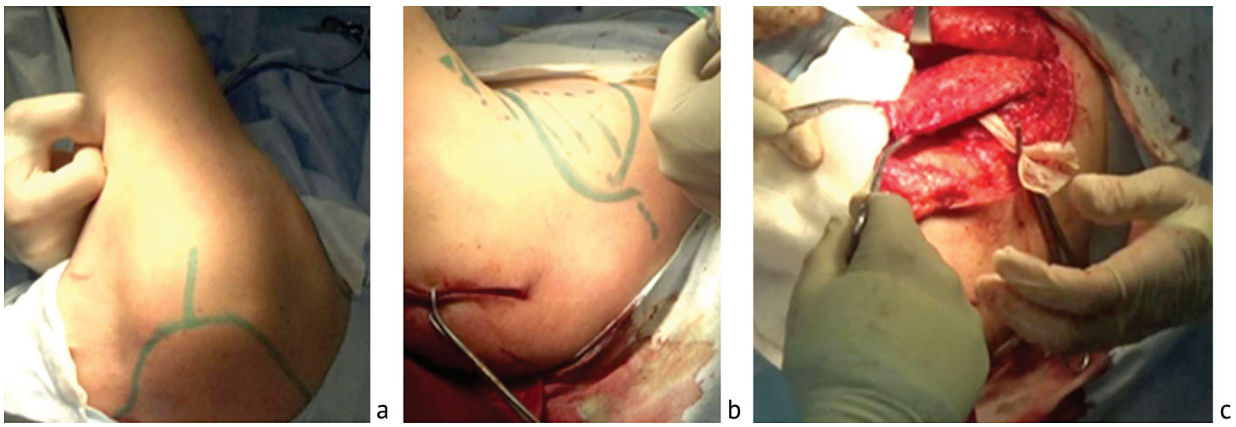

Fig. 3 Approaches for transposition of the musculoskeletal block of the trapezius (a) and latissimus (b) muscles, separation and mobilization of the latter according to the Saha method (c)

RESULTS

The postoperative period was uneventful for the wounds and hemostatic balance. Healing was obtained by primary intention and postoperative blood loss did not exceed 100 ml. Clotting disorders were not observed during laboratory control. A comprehensive course of rehabilitation was prescribed at the end of immobilization according to rehabilitation protocols. The patient showed improved function of the right shoulder after 8 months. ROM according to Marx significantly increased with abduction of 45º, flexion 55º and extension of 45º (Fig. 4).

DASH scores decreased to 52 and VAS score decreased to 31.The level of self care improved significantly. The patient could lean on his hand, could eat, take shower, wash, comb his hair, brush his teeth unassisted. He subjectively rated his result of treatment as good.

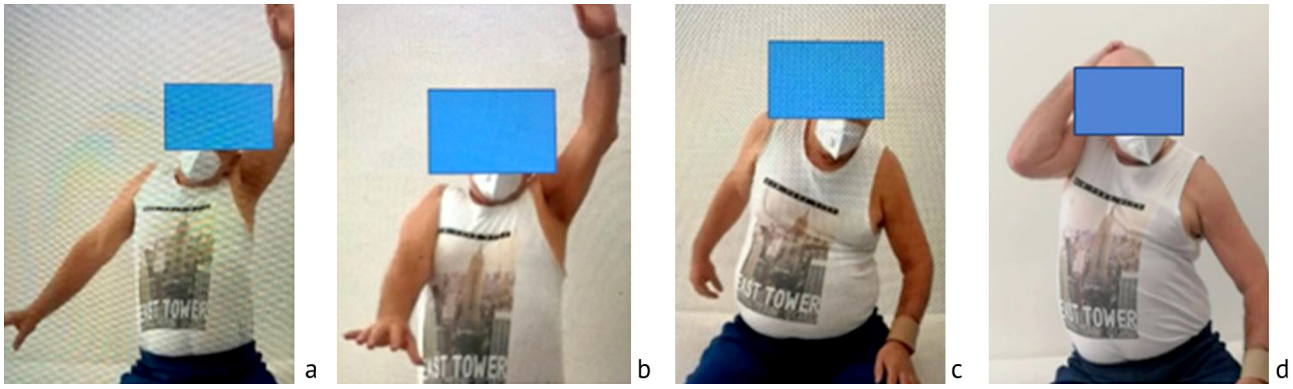

Fig. 4 Right shoulder function 8 months later

DISCUSSION

The case presented was characterized by severe post-traumatic disorders of the function of the right (leading) shoulder girdle in a patient of working age with a history of a very formidable hemostatic comorbid. The treatment of such patients is a difficult task and remains controversial in terms of the timing and technology of the surgical treatment, and rehabilitation in the postoperative period. Based on clinical, instrumental and laboratory findings dynamic surgical strategy was provided for the patient for a period of 6 months of the injury with the procedure performed by two surgical teams to reduce the operating time, blood loss and other risks. Combined simultaneous myofascio-grafting techniques of muscle transfer used to replace the lost function of injured muscles with adequate control and prevention of thromboembolic complications could facilitate significant progress in the anatomical and functional status of the patient. The long-term outcome was supported by a personalized outpatient rehabilitation program developed for a specific case in the absence of a standard rehabilitation protocol for the cohort of patients. Nevertheless, further search for rational reconstruction and rehabilitation technologies seems appropriate for the above conditions.

CONCLUSION

Tendon transfer of the intact shoulder muscles to replace the lost function of antagonists (deltoid and rotator cuff) due to neuropathy based on clinical and instrumental findings can provide improved function for the upper limb and quality of life with adequate thromboprophylaxis facilitating control of hemostasis and absence of vascular failures.

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Information about the authors:

1. Oleg A. Kaplunov – Doctor of Medical Sciences, Professor, volortho@mail.ru;
2. Sergey A. Demkin – Candidate of Medical Sciences, demkin@vlg.sovamed.ru;
3. Kamil F. Abdullaev – Candidate of Medical Sciences, drabdullaekamil@gmail.com;
4. Kirill O. Kaplunov – Candidate of Medical Sciences, kkaplunovtmss@yandex.ru;
5. Anastasiya A. Malyakina – M.D., amalyakina0320@bk.ru.