Although rupture of the long head of biceps is a fairly common event, its etiology in young healthy individuals has been assumed to be related to an extraordinarily strong muscle contraction. In this report we describe such a rupture following minor trauma in a reinnervated muscle. The case brings up several points of interest concerning tendon tensile strength and potential for rupture.

**Keywords**: biceps tendon; rupture; reinnervation.

**Mots-clés**: tendon bicépital ; rupture ; réinnervation.

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**INTRODUCTION**

Rupture of the long head of the biceps muscle is a common and well known injury. Several underlying disorders have been described as causes of biceps tendon rupture (8). Among these, degenerative changes in the glenohumeral joint and in the tendon of the long head are the most important in older people, while an unexpected, brisk contraction of the biceps is the commonest cause in young and athletic persons (1). As far as we know, there is no report on biceps tendon rupture following microneural repair of the musculocutaneous nerve (as part of an open brachial plexus injury).

**CASE REPORT**

This sixteen year old student sustained a power chainsaw injury which penetrated quite deeply into his brachial plexus just above the left clavicle in September 1981. The wound was closed in a local hospital and 10 days later he was referred to our hospital.

Clinical examination revealed loss of mobility of the left shoulder, loss of elbow flexion and forearm supination. Elbow extension and pronation, as well as wrist and finger movements were essentially normal. Anaesthesia was noted at the site of injury and along the radial volar side of the arm and forearm.

![Fig. 1. — Transection of C4 root and superior trunk (C5-C6).](image)

Two weeks after the initial trauma this young man was taken to the operating room for exploration of the brachial plexus. At operation a complete transection of C4 root and the superior trunk (C5-C6) was found (figure 1). The supra-
scapular nerve was found to be avulsed from the muscle. It was carefully reinserted back into the muscle with the hope of functional return by neurorization. The lower plexus showed no injury but was explored and mobilized into the axilla, in order to facilitate direct repair of the upper plexus lesion. The C4 root and superior trunk were repaired without tension with the aid of the operating microscope (figure 2). The deltoid muscle and elbow flexors subsequently regained good muscle power, grade IV-V (figure 3). However, external rotators of the shoulder (M. supra- and infraspinatus) remained weak, grade III.

The young man took part in all activities including contact sports, hunting and motorcycling. He diligently followed a vigorous weight-lifting program to strengthen his muscles.

In October 1984, 3 years after the nerve repair, while engaging in a tug-of-war, he experienced a sudden snap and pain in the left shoulder and arm. Physical examination revealed the belly of the biceps muscle bulging in the lower third of the arm, with widening of space between deltoid and biceps (figure 4). Shoulder movement and elbow flexion remained very powerful. The surgical options and alternatives were explained to the patient. After due consideration he elected to strengthen his muscle by weightlifting and avoid further surgery.

**DISCUSSION**

Rupture of the tendon of the long head of the biceps muscle was first described by J. G. Smith in 1835. Morton in 1886 first reported the results of surgical repair. Gilchrist in 1934 reported 100 cases and gave a thorough description of the anatomy, pathology and treatment. He found that most ruptures occurred in the intra-articular portion and in the proximal musculo-
tendinous junction. Bateman describes the inter-
tubercular fulcrum as the weak point where wear
and tear of the tendon eventually leads to complete
rupture.

The need for operative reconstrucion is some-
what controversial (1). Soto-Hall and Strooth
studied the power of flexion of the elbow and
abduction of the shoulder with the arm in external
rotation in patients with rupture of this tendon.
Evaluation soon after rupture revealed a 20% de-
crease in the strength of elbow flexion and a
17% decrease in the strength of shoulder abduc-
tion. Late ruptures, however, showed no differ-
ence in strength. The strength of a ruptured biceps
muscle has also been tested by Warren (5) et al.
Two years after chronic ruptures of the long head
of the biceps they failed to reveal any statistically
significant loss of elbow flexion but an approxi-
mate 10% loss of elbow supination was noted.

Because of the minimal functional disability
Watson-Jones considered operative reconstruction
only in terms of cosmesis, while others support
the need for reconstruction in young people and
athletes. In case of reconstruction, some authors
prefer to fix the tendon of the long head in the
bicipital groove, while others (4, 5) prefer to suture
the ruptured tendon back to the coracoid and
short head of the biceps muscle to maintain the
muscle action across the shoulder joint. When
reconstruction is performed in middle-aged per-
sons, rotator cuff tears must be suspected because
of the high frequency of association with biceps
tendon ruptures.

We report the history of a young healthy man
who sustained an open brachial plexus lesion. A
microneural direct repair was done as a delayed
primary procedure. Subsequently the patient regai-
ned good function and muscle power (grade IV-V)
in the elbow flexors and deltoid muscle. External
shoulder rotation remained weak (grade III), due
to inadequate recovery after neurotization with the
suprascapular nerve. As a result of minor trauma,
3 years after the repair, he ruptured the tendon
of the long head of the biceps muscle.

Some points warrant further discussion. Has
the tendon tensile strength been weakened fol-
lowing a nerve repair? If so, has this intrinsic
weakness rendered the tendon susceptible to rup-
"ture? Gilcreest estimates the tensile strength of the
tendon of the long head to be about 150 pounds,
while in cadaver studies it was found to be
from 150 to 200 pounds. Review of the English
literature of the last 15 years gives no data on
changes in tensile strength of muscle or tendons
after successful reinnervation. The fact that this
young man ruptured his biceps tendon as a result
of only minor trauma may suggest a weakened
tendon. The mechanical properties, especially ten-
sile strength, of reinnervated muscle and tendon
need further experimental attention.

The very good recovery of the biceps muscle
after direct repair as a delayed primary procedure
also warrants further attention. Seddon (12) states
that the results of musculocutaneous nerve repair
are excellent, indeed better than those of any other
nerve in the body. Direct repair of brachial plexus
injuries is however rarely possible (2, 3). Sedel (3)
reports one case with transection of the upper
trunk where direct repair was performed, but
under slight tension. No recovery was noted after
4 years. In our case, by mobilization of the plexus
into the axilla a direct repair was possible despite
some crushing of the nerve ends related to the
type of injury (chainsaw). He regained such muscle
power in his biceps that he ruptured the tendon
3 years after neural repair. The overall favourable
reputation of biceps recovery may be explained
by the relatively short distance of nerve regen-
eration, so that the end organ is less likely to
undergo end plate fibrosis.

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SAMENVATTING

*M. DEMUYNCK, R. M. ZUKER. Ruptuur van de lange biceps kop na succesvolle reïnnervatie.*

Ruptuur van de lange kop is relatief frequent bij jonge personen en komt vooral voor na korte krachtige inspanning. In dit artikel wordt een ruptuur van de lange kop beschreven in een gereinnerveerde bicepsspier na plexuslaesie. De ruptuur was een gevolg van een mineur trauma. Bedenkingen omtrent peessterkte en risico op ruptuur na reïnnervatie worden hierbij gemaakt.

RÉSUMÉ

*M. DEMUYNCK, R. M. ZUKER. Rupture du tendon de long biceps après réinnervation réussie.*

La rupture du tendon bicipital est relativement fréquente et se manifeste le plus souvent après une importante activité physique. Dans ce rapport, une rupture du tendon bicipital est décrite sur un muscle réinnervé après lésion du plexus brachial. La rupture était la conséquence d’un traumatisme mineur. On peut s’interroger au sujet de la qualité du tendon et du risque de rupture après réinnervation.