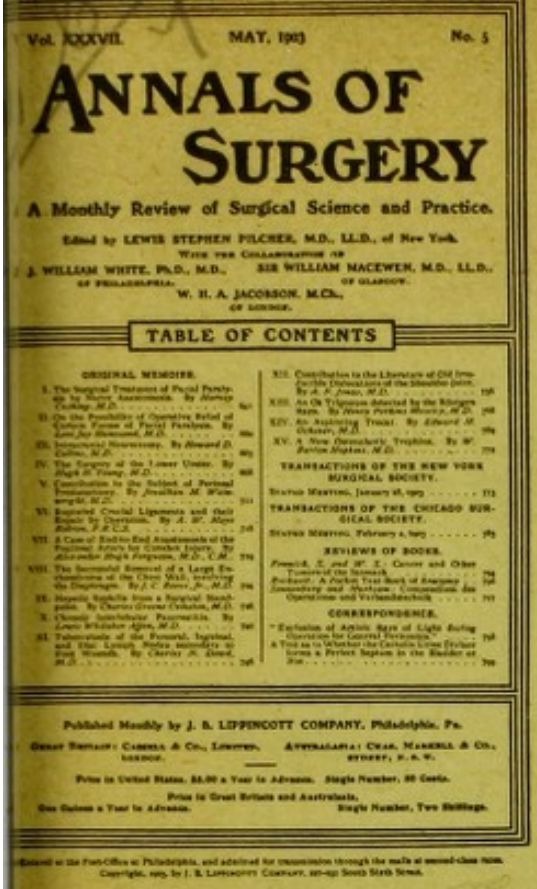
**Rupture of the tendon of the biceps flexor cubiti : a case of rupture of the long tendon in its continuity, and one of rupture of the same tendon at the glenoid attachment : operation with successful result in each case / by William W. Keen.**



Vol. XXXVII. MAY, 1903 No. 5

ANNALS OF SURGERY

A Monthly Review of Surgical Science and Practice.

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TABLE OF CONTENTS



Published Monthly by J. B. LIPPINCOTT COMPANY, Philadelphia, Pa.

Great Britain: Cassell & Co., Limited, London. Australasia: Chas. Maskell & Co., Sydney, N. S. W.

Price in United States, $5.00 a Year in Advance. Single Number, 50 Cents.

Price in Great Britain and Australasia, One Guinea a Year in Advance. Single Number, Two Shillings.

Entered at the Post-Office at Philadelphia, and admitted for transmission through the mails at second-class rates.



# RUPTURE OF THE TENDON OF THE BICEPS FLEXOR CUBITI

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Reprinted from Annals of Surgery, May, 1905

# RUPTURE OF THE TENDON OF THE BICEPS FLEXOR CUBITI.[1]

A CASE OF RUPTURE OF THE LONG TENDON IN ITS CONTINUITY, AND ONE OF RUPTURE OF THE SAME TENDON AT THE GLENOID ATTACHMENT; OPERATION WITH SUCCESSFUL RESULT IN EACH CASE.

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CASE I.—Dr. John B., aged fifty-four years, who regularly practises athletic exercises, first consulted me, December 16, 1904. His father and mother suffered from rheumatism and neuralgia. He himself had had muscular pains from time to time, but never a distinct attack either of articular or muscular rheumatism. He has had several attacks of diarrhœa. Five years ago had a severe attack of pleuropneumonia. When twenty years old was only five feet tall and weighed ninety pounds; at twenty-four his height was five feet two inches and he weighed 106 pounds. After his attack of pneumonia he weighed but eighty-five pounds. At present his height is five feet six inches and his weight 125 pounds. When a young man, his health was so poor that he was advised to go to Colorado. His persistent athletic practices are readily explained as a means he has adopted, and very successfully, to obtain robust health. Even in the very cold weather of this winter, I found that he only wore an open meshed undershirt.

In June, 1902, a pupil by accident let an Indian club slip, striking Dr. B.'s right shoulder on the anterior surface while the muscles were tense. No ecchymosis followed, but for six months abduction of the elbow was impossible, not from pain, but from muscular inability to lift the elbow. Twice since then he missed catching a hand-ball and fell forward, striking on his right shoulder.

On December 8, 1904, in a violent muscular effort to catch a hand-ball, he suddenly felt a pain about the junction of the upper and middle thirds of the right arm, so severe that he stooped

[1] Read before the Philadelphia Academy of Surgery, February 6, 1905.

and twisted his body to enable him to bear the pain. He noticed a lump on the arm, but paid little or no attention to it, as the pain quickly subsided. On December 13, he made a hand-spring, and again felt the pain at the same place.

On examination, December 16, I found that when he made forcible flexion of the forearm to a right angle and I resisted the flexion, the biceps' belly terminated at its upper portion suddenly, and I could not feel the tendon above that point. The upper end of the belly of the biceps also felt very flabby and soft, almost as if it were a hæmatoma, though not quite so soft.

My diagnosis was a rupture, more likely of the long head of the biceps. He had had but little pain, and his disability

FIG. 1.—The tortuousness of the tendon of the long head of the biceps.

FIG. 2.—Shows the fusiform swelling of the tendon below the bicipital groove and the mode of shortening the elongated tendon and suturing the two ends while held taut.

as a result of the accident both he and I estimated at about 25 per cent. The difference in outline of the two arms was more marked to the touch than to the eye, and hence I do not reproduce the photographs taken at the time.

In view of his athletic disposition, I advised and he accepted immediate operation.

*Operation*, December 18, 1904. I laid bare the biceps muscle and its upper tendons. The short head I found intact. The tendon of the long head lay tortuous like a snake (Fig. 1), extending from the body of the muscle upward. I had expected to find the tendon torn away from the belly of the muscle, but I found the two continuous. Traction on the tendon showed that

its attachment to the rim of the glenoid cavity was also firm. I dissected under the deltoid for a short distance upward till I reached the groove in the head of the humerus. About two centimetres below the groove began a fusiform swelling in the tendon extending downward about 1.5 centimetres (Fig. 2). This portion of the tendon was markedly discolored, almost black, evidently from blood effused within the sheath, but the sheath was intact. It was clear, therefore, that the tendon itself had been torn or ruptured within its sheath, and was much elongated, this partially destroying the function of the muscle. I severed the tendon just below the discolored portion, and, while each end was held taut overlapping the other about two centimetres, I sutured the two ends together with twenty-day chromicized catgut (Fig. 2). The arm was then placed on a rectangular splint so as to relax the biceps muscle. He went home, December 26, with the wound entirely healed.

January 26, 1905. He called to see me to-day. The splint was worn for two weeks after the operation, and the forearm was carried in a sling for two weeks more. At the end of that time he tells me he began doing athletic "stunts" with the arms, and has felt only the inconvenience which comes from weakness of the right biceps, due partially to non-use for a month. The muscular belly is quite flaccid as yet, and it is smaller than that on the right side by half a centimetre. The exercises he has taken have not been violent or prolonged, and presumably the biceps will improve very much in time.

[March 31. He is now practically as well as ever. The deformity of the biceps has almost disappeared.]

Case II.—Dr. J. Chalmers Da Costa has kindly given me the following notes of his case: "In May, 1904, a man, aged fifty-two years, while lifting a heavy bucket or pail, was suddenly seized with violent pain in the upper arm. He dropped the bucket, and for several days kept his arm bandaged and in a sling. I first saw him several days after the accident. Flexion of the forearm could be slowly executed, but was feeble, painful, and incomplete. On attempting flexion, the short head of the biceps contracted and the belly of the muscle became abnormally prominent, but the muscular 'bunch' thus produced was flabby and nearer the elbow-joint than normal. An incision disclosed the long head of the biceps curved like a snake. When pulled upon,

it came entirely out of the bicipital groove. A portion of the periosteum had been torn off with the tendon, evidently from the margin of the glenoid cavity. A portion of the upper end of the tendon was cut off and the tendon was attached to the short head by splitting the latter and suture. Primary union followed. At present, nine months after the accident, the arm and forearm are strong and active. He uses the arm for all purposes of hard work without pain. The biceps actively flexes the forearm; the short head is much enlarged."

REMARKS.—Prior to the present cases there have been published only one case of operation for rupture of the belly of the biceps and one for rupture of the tendon.

Loos (*Beiträge zur klinischen Chirurgie*, 1900, Vol. xxix, p. 448) is in error when he states that Legueu operated. (See *Revue de Chirurgie*, 1895, Band xv, p. 897.) No operation was done by Legueu, and the cicatricial node in the tendon was not in the biceps, but the triceps tendon. The article of Loos just referred to and the earlier one by Maydl (*Deutsche Zeitschrift für Chirurgie*, 1882, Vol. xvii, pp. 306 and 513, and Vol. xviii, p. 35) covered most of the published cases up to 1900. These amounted to sixty-six in all.

I have not made further search of the literature than through my own card catalogue. This shows that there should be added to Loos's list the four cases reported by G. G. Davis (*Medical News*, 1895, Vol. lxvii, p. 121), Da Costa's, and my own cases herewith reported. These make a total of seventy-two cases. Loos states (p. 430, foot-note) that Petit has collected eighty-three cases of rupture, but that the paper had not been published in 1900, nor have I found it since.

It is a matter of surprise that a tendon should rupture in its continuity rather than that the muscular belly should yield or the tendon be torn loose from the muscular belly at the point of transition from the one to the other, or from the bony attachment of the tendon. There is, however, no doubt, as in my case, that this does occur.

I think Davis is, however, probably right when he says "the tensile strength of healthy tendon is so great that it is

my belief that true rupture is much rarer than is usually supposed, and that when a tendon does rupture, it is very likely to have been diseased." Yet, on the other hand, in a number of cases no prior disease was known. In the present case, in view of his prior history and later athletic life, there may or may not have been disease of the tendon.

Rupture of the biceps may take place at several points:

(1) In the belly of the muscle,

(*a*) Either that portion belonging to the long head;

(*b*) That belonging to the short head, or,

(*c*) The belly after union of these two portions.

(2) At the transition point between the muscular belly and one of the upper tendons.

(3) The transition point between the belly and the lower tendon.

(4) In the continuity of the tendon of the long head.

(5) At the point of insertion of this tendon to the rim of the glenoid cavity, or at least within the capsular ligament.

In some cases it is not easy to make an exact differentiation of the site of the rupture, hence all tables are to some extent unreliable. It is to be noted that *only in the operative cases has the exact* condition been verified by sight.

The combined cases of Loos, Davis, and this paper give for rupture of the muscle itself fifty cases as against twenty-two in the tendons, but of fifty-six cases in Loos's paper with more detailed histories to which Davis's four cases and these two are added, making sixty-two in all, there were forty-one of the muscle and twenty-one of the tendon. But from these twenty-one of rupture of the tendon six should be deducted as being at the point of junction of the tendon and the belly and the case of Legueu, which should not have been included. This leaves only fourteen cases of rupture of the tendon. The belly of the short head was only involved in two cases, and both of these were due to direct injury,—one in a threshing-machine, in which the tendon of the long head was also involved, and the other in an attempt at reducing a luxation of the shoulder.

In the larger series of Petit, the proportion is given as follows:

Rupture of the whole muscle, 21; of the long head, 9; at the transition point between belly and tendon, 7; of the lower tendon, 3; of the tendon of the long head, 43.

I think that there must have been some error in transcribing, for it would be extraordinary to have forty-three cases of rupture of the tendon of the long head and only nine of the muscular part of the long head. As stated, Petit's paper has not yet been published.

Besides the case here reported, there are only six cases of stretching or partial rupture of the long head similar to the present cases. Of all the cases reported by Loos, only four of rupture of the muscle and one of the tendon were caused, as in the present care, by muscular effort alone.

Of all the reported cases only two occurred in women.

The symptoms of rupture differ in rupture of the belly of the muscle and of the tendon. The muscular belly, either the whole of it, or (if the rupture involve, for instance, only the belly of the long head) a part or the whole muscle, becomes softened and loses its elasticity. Sometimes, in rupture of the belly into an upper and lower portion, there will be two tumors formed by the contraction of the two portions of the belly of the muscle, with a marked furrow between them from one to two fingers'-breadths wide. At the bottom of this furrow, sometimes even the bone can be felt. If the rupture is at the junction of the tendon with the belly, this double tumor, of course, will not exist, but there will only be a tumor of the belly and none of the tendon. If the rupture be of the belly of the long head, the muscular belly of the biceps will be drawn towards the elbow. If the rupture be at the lower end of the belly of the muscle, the whole muscle will be drawn up nearer the shoulder.

In an excellent paper by White (*American Journal of the Medical Sciences*, January, 1884, p. 17), on dislocations of the long tendon of the biceps, the differential diagnosis between that lesion and rupture of the long head of the muscle is well

stated; and one other point of importance is mentioned, namely, that in rupture, the head of the humerus, not being held down by the long tendon, is approximated more closely to the acromion, and the shape of the shoulder correspondingly altered.

When the long tendon is ruptured completely or partially, the symptoms are less pronounced, partly because only a portion of the muscle is involved and partly because the sheath of the tendon to some extent replaces the tendon. Of course, there is much less ecchymosis and the discoloration is not pronounced. Only the portion of the muscle corresponding to the long head is flabby and has lost its tone, so that it feels like a cyst or a hæmatoma.

Unfortunately, in my case, I did not observe whether Hüter's symptom was present. He called attention to the fact that flexion of the forearm in supination when the biceps is relaxed is much less forcible than when the hand is in pronation, and the biceps is more tense and can contract to greater advantage.

*Treatment.*—The treatment in almost all cases has been either none at all, where patients have neglected to seek the surgeon till long after the accident, or by means of a bandage with or without a splint, massage, and electricity. I mention the latter only to condemn it save in the *later stages,* after the rupture is healed. Then it will do much good in restoring the functional activity of the muscle. Earlier than this it would but separate the two portions instead of approximating them.

In a few cases good functional results have been obtained, for it is possible sometimes, by manipulation and bandaging, to approximate the two parts of the muscle if the rupture be in the muscle, so that union will take place by fibrous tissue with but little loss of function. If the rupture be confined to one portion of the muscle, of course the chances of restoration of function are much better than when the whole of the muscle is involved. Yet, often in the cases of only partial rupture, loss of function is very marked. This is not only

due to the separation of the ends of the muscle or of the tendon and the lengthening of the muscle by the length of the scar tissue which fills the gap, but also from wasting of the muscle, from interference with its innervation.

It is strange that surgeons have so rarely operated. The cases in which operations have been done thus far are as follows:

1. Von Hochstetter (*Wien. med. Woch.*, 1890, p. 399). A very muscular man of forty-six years. Over two months after the injury, the upper end of the belly of the muscle and the tendon which had been torn loose from the belly were united with silk. After four months complete ability to work returned.

2. Bazy (*Bull. Soc. de Chirurgie*, 1895, p. 156). A man, aged forty years, in whom there was a complete rupture of the tendon of the long head within the joint or even detachment of the tendon from the glenoid cavity as a result of lifting a sack weighing eighty kilogrammes. The tendon was reflected upon itself so that the torn upper end was turned downward. Bazy resected the tendon and united the stump to the tendon of the short head and the coraco-brachial. The arm was placed in plaster at a right angle. After one month there was complete restoration of function.

3. In my own case, the patient at the end of a month resumed, to a moderate degree, his athletic occupation and is now quite himself again.

4. The case of Dr. J. Chalmers Da Costa. The lesion and the operation were identical with Bazy's case. The result was very satisfactory, entire use of the arm having been regained.

The most encouraging results from these four cases of operative interference and the poor result in many others not so treated, it seems to me, should lead to operative treatment of cases of rupture rather than to trust to the more or less uncertain results of the treatment by bandages and splints.