

# AVULSION OF THE DISTAL TENDON OF BICEPS BRACHII FROM THE RADIAL TUBEROSITY

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Closed rupture of the biceps muscle or its tendons following indirect violence is a comparatively rare injury and when it occurs the rupture is more likely to affect the long head of origin than the distal tendon. While ruptures of the long head have received adequate attention in surgical text-books, the same cannot be said for avulsion of the distal tendon and the surgeon encountering this lesion for the first time may not be fully prepared to deal with the pathology disclosed at operation.

Storhsin first identified the lesion at autopsy in 1842.<sup>9</sup> Credit for the first clinical description has been given by most writers<sup>8,27</sup> to Aquaviva<sup>1</sup> (1898), but Lee<sup>18</sup> has pointed out that in 1897 Johnson<sup>14</sup> reported on a case in the *New York Medical Journal*.

## *Frequency*

Views of different writers vary not only in regard to the frequency of bicipital ruptures in general but also as to the relative incidence of ruptures of the long tendon as compared with distal avulsions.

Platt<sup>22</sup> stated, 'Rupture of the long head of the biceps is by no means an uncommon injury'; but his personal series of operations for complete tendon ruptures included

no example of rupture of the long head of biceps. He could find no record in the literature of rupture of the distal tendon, but had operated on a case of avulsion of this tendon from the radial tuberosity. Watson-Jones<sup>26</sup> lists various predisposing factors which explain the 'frequency' of rupture of the long proximal tendon of biceps, but stated that less than 40 cases of rupture or avulsion of the distal tendon had been recorded.

Mercer<sup>21</sup> agrees that 'rupture of the biceps insertion at the elbow is exceedingly rare' and quotes the case reported by Platt. However, Harris<sup>13</sup> and Keen<sup>15</sup> could trace only about 100 recorded cases of rupture of the long head in the literature up to 1935.

Gilcreest<sup>10</sup> in a comprehensive review of the whole subject of bicipital ruptures in 1934 analysed 100 reported cases, of which 73 had been subjected to operation. The comparative rarity of this type of injury was indicated by the fact that only 15 cases could be collected from the Mayo Clinic over a 15-year-period. In the series reviewed by him, Gilcreest found the long head involved in 57 cases, the muscle belly or musculo-tendinous junction in 40, and the distal insertion in only 3. He compared these figures with those of Petit (which were respectively 52, 28 and 3) and

Biancheri (96% long head, 3% distal tendon). At that time there were apparently only 19 cases of rupture of the lower tendon previously recorded in the literature.

Between 1937 and 1939 Dobbie<sup>6</sup> encountered 2 cases of disinsertion of the distal biceps tendon and was able to trace only 24 cases reported in the literature. He circulated 490 members of various surgical and orthopaedic associations in America and was able by this means to collect 51 further cases not previously reported. Lee<sup>18</sup> in 1951 brought the total of recorded cases up to 98.

In this paper I draw attention to a further 18 cases reported by various authors,<sup>3-5,7,8,12,16,27</sup> and give details of 2 additional cases seen at the Chamber of Mines Hospital, Johannesburg, during the past year.

Since this hospital was opened in 1939 for the treatment of injured miners, 32,752 patients have been admitted, and our records show the following figures for major or complete ruptures of muscles and tendons of the shoulder and upper limb:

Supraspinatus	..	..	..	..	..	6
Biceps: Long head	..	..	..	..	..	4
Muscle belly (direct violence)	..	..	..	..	..	2
Distal tendon (avulsion)	..	..	..	..	..	2
Triceps (partial avulsion, central slip, distal tendon)						1

These figures may be compared with those of Stimson, quoted by Christie,<sup>4</sup> who found 3 cases of rupture of the biceps out of 10,000 injured patients examined, and Waugh,<sup>27</sup> who encountered 50 cases (45 involving the long head and 5 the distal insertion) out of 60,792 admissions.

It is of interest to note that Waugh places the biceps first in order of frequency of muscle and tendon ruptures while Gilcreest, who contributes the chapter on the surgery of muscles and ligaments in Christopher's *Text-book of Surgery* gives the order: (1) Calf muscles, (2) extensors of leg, (3) biceps of arm, (4) Achilles tendon, (5) extensors of thumb.

#### Aetiology and Pathology

Avulsion of the biceps tendon from the radial tuberosity occurs usually in males in the 5th and 6th decades. Though it is rare under the age of 40, there are 2 recorded instances in patients aged 32.<sup>18,27</sup>

Typically the lesion results from sudden forcible extension of the actively flexed elbow, and the dominant arm is the one commonly affected. Most surgeons who have resorted to operation have commented on the fact that the avulsion is a 'clean' one, leaving a smooth area on the tuberosity without tendinous remnant or elevation of bone flakes. Davis<sup>5</sup> has suggested the possibility of a hypertrophic anterior edge of the tuberosity leading to frictional changes in the tendon, but this feature has not been previously described, nor was it encountered in the patient operated on here.

#### Symptoms and Signs

The following are so constant as to be pathognomonic:

1. Immediate pain in the antecubital region, occasionally with the sensation of a 'snap'.
2. Local tenderness and slight swelling in the antecubital region with ecchymosis developing in 2 or 3 days.
3. Deformity of the biceps with the belly retracted proximally.

4. Biceps tendon cannot be palpated while brachialis becomes more easily palpable.

5. Weakness in power of elbow flexion and supination.

#### Treatment

All writers have advocated operative treatment, but Waugh<sup>27</sup> has added, 'Treatment depends upon the degree and site of the rupture, the age of the patient, . . . the kind of work the patient may have to do in the future.'

The operations devised have had as their objective one of two alternatives:

1. Reattachment of the tendon to the radial tuberosity by nail, *via* drill holes or other means.<sup>2,3,10,17,18,22</sup>
2. Suture of the detached biceps tendon to the soft tissues, particularly the tendon of brachialis.<sup>6,11,16,27</sup>

Those who favour the second alternative consider that surgical exposure of the radial tuberosity is not without risk of damage to important structures, and is not essential from the point of view of restoring function.

The results following operation have in the main been described as 'good' or 'excellent', irrespective of the type of operation performed. It is worthy of note, however, that even when conservative treatment is adopted, the permanent functional disability in the elbow is not great.

#### CASE REPORTS

##### Case 1

Mr. G.E., aged 49, an instructor at the Government Mining Training School, reported at this hospital on 13 November 1956, complaining of pain in the right elbow region. He stated that at 11 a.m. the previous day, while walking down a gully underground, he had slipped and, to save himself falling, had thrown his right arm round a supporting prop, at the same time flexing the elbow forcibly. As he regained his feet he experienced a cramp-like pain in the right biceps muscle, which he found bunched up towards his shoulder. He pushed the muscle down towards his elbow with his left hand and this relieved the cramp, but a short while later he attempted to lift some object and the cramp and deformity of the biceps recurred temporarily. The following morning he noticed an area of 'bruising' on the elbow and saw his panel doctor, who referred him to the Chamber of Mines Hospital.

On examination, the salient features were:

1. Ecchymosis on the medial aspect of the right arm in its lower third, the elbow and the upper two-thirds of the forearm.
2. Tenderness in the antecubital region.
3. Deformity of the biceps, the belly of which was bunched into the proximal half of the arm, especially during strong active contraction.
4. Absence of biceps tendon in antecubital region; brachialis more easily defined.
5. Full flexion and extension of elbow but power of flexion and of supination diminished.

Operation was undertaken on 22 November by Mr. E. B. H. Trehair, F.R.C.S., under general anaesthesia and a bloodless field, when I acted as assistant. Henry's incision was used and once the radial recurrent leash of vessels had been ligatured and cut, a very good exposure of the operative field, including the tuberosity of the radius, was obtained. The distal biceps tendon was found lying quite free on the underlying brachialis muscle, with its extreme tip bulbous and slightly haemorrhagic (Fig. 1). A hiatus was found in the soft tissues where the tendon had 'pulled out' and a director could be passed through this down to the tuberosity of the radius. After a small portion of the supinator muscle had been reflected, and with the forearm in full supination, the tuberosity was well exposed and the bare area about  $\frac{1}{4}$  of an inch in diameter from which avulsion had occurred was clearly seen. This was quite smooth, with no suggestion of ridging or flaking. Two drill holes were made transversely through the tuberosity, its surface was roughened slightly and the biceps tendon was sutured into position with braided wire (Fig. 2).

The elbow was immobilized in almost full flexion and supination

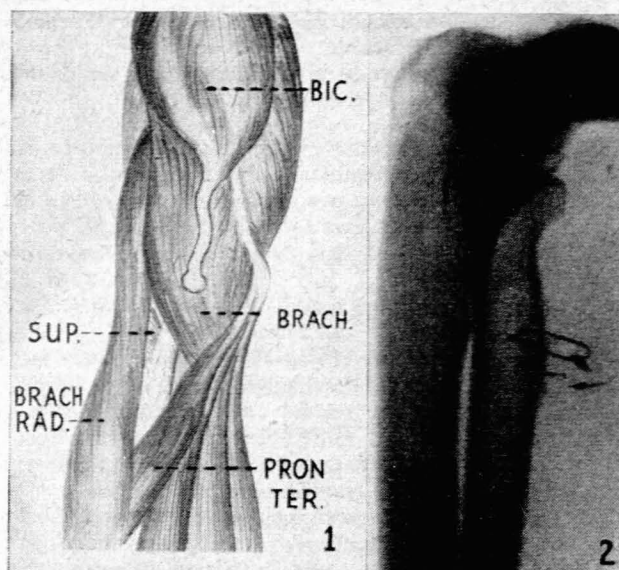


Fig. 1. Case 1. Names of muscles: bic.=biceps, brach.=brachialis, sup.=supinator, brach. rad.= brachioradialis, pron. ter.=pronator teres.

Fig. 2. Case 1.

for 3 weeks and then at a right angle for a further 2 weeks, after which active exercises were instituted.

The patient resumed work 10 weeks after the operation and was finally examined for assessment of permanent disability on 9 May 1957. At that stage the biceps contour was normal and the distal tendon could readily be felt spanning across the antecubital fossa. Flexion was full but extension was limited by 20°; supination was full and powerful, but pronation was limited by 30°. By merely flexing the elbow he could lift 15 lb. on the right and 20 lb. on the left. Permanent disability was assessed at 7½%.

#### Case 2

Mr. L.H.L., aged 64, a construction worker underground, reported at this hospital on 8 February 1957 about 2½ hours after an injury to his right elbow region. He stated that he was holding up one end of a pipe when the men who were lifting the other end up a vertical shaft suddenly let go, so that he took the whole weight of the pipe on his right forearm, his elbow being held at right-angled flexion. He experienced a sharp pain over the front of the elbow and a feeling of weakness. He was sent direct to the Chamber of Mines Hospital.

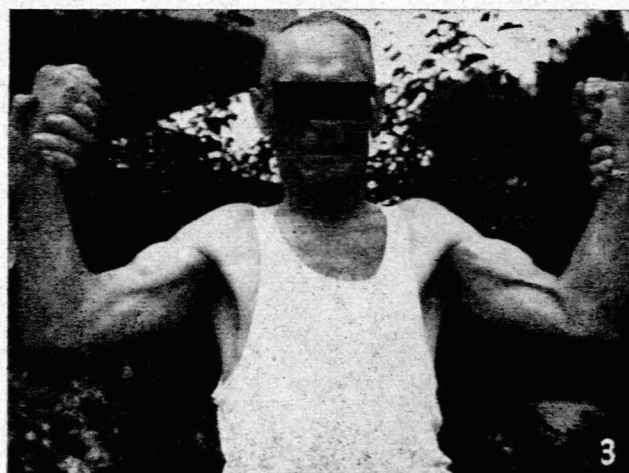


Fig. 3. Case 2.

The clinical features, as shown in Fig. 3, were identical with those of the previous patient except that the ecchymosis did not appear until 2 days later and was distributed chiefly over the medial and posterior aspects of the elbow, and the upper third of the forearm. X-ray was negative. In view of the patient's age, a conservative line of treatment was adopted—radiant heat, light massage and gentle active movements at a comparatively early stage.

Two weeks after injury it was noted that extension of the elbow became limited by 25° and the skin was slightly puckered and adherent over the site of the distal biceps tendon. This restriction of movement disappeared after a further 2 weeks and he resumed work 6 weeks after injury.

At the time of final examination on 10 June, the biceps deformity was still present, the distal tendon could not be felt, and the slight 'dimpling' of the skin over the distal tendon was still evident. Flexion and extension, pronation and supination were all full. Supination power was diminished by about one-half. By flexing the elbow he could lift 12½ lb. on the right, 17½ lb. on the left. If the forearm was supinated he used the brachialis chiefly to flex the elbow; in pronation and neutral position the brachioradialis also contracted strongly. Permanent disability was assessed at 5%.

#### CONCLUSIONS

1. While rupture of the biceps is not a common injury and when it occurs is most likely to affect the long head, avulsion of the distal tendon from the radial tuberosity is not so rare as to be regarded as a surgical curiosity.

2. The syndrome is so characteristic that diagnosis presents no difficulty.

3. If surgical repair of the lesion is contra-indicated by the age of the patient, or for other reason, the functional disability in the elbow is not gross.

4. If operation is undertaken, reattachment of the tendon to the tuberosity of the radius should be carried out; this improves the power of supination. There has been a tendency to place too much stress on the risks involved in surgical exposure of the tuberosity. If Henry's approach is used the operation offers no particular technical difficulties.

I should like to thank the management of the Rand Mutual Assurance Co. for authority to publish these cases, Mr. E. B. Trehair for permission to publish his case, and Mr. I. Macgregor for making the diagrammatic drawing (Fig. 1).

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