RUPTURE OF THE EXTENSOR POLLICIS LONGUS TENDON AFTER COLLES FRACTURE*

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Subcutaneous rupture of the extensor pollicis longus tendon was first reported by Duplay in 1876. His patient, a woman aged thirty-six years, had fallen and injured her hand, without, so far as could be ascertained, sustaining a fracture. Kleinschmidt reviewed the literature in 1929 and found twenty-five examples of the rupture as a late complication of Colles fracture; McMaster, reporting a case in 1932, found twenty-seven others in the literature. Moore in 1936 recorded three examples, but by 1940 Kwedor and Mitchell were able to trace seventy cases and added a further one. Smith added five more in 1946.

This paper records the personal experience of nine patients with rupture of the tendon after fracture of the lower end of the radius.

CLINICAL FEATURES

The clinical features did not differ materially from those previously recorded in the literature (see Table I). In all nine patients the posterior aspect of the lower end of the radius was involved by the fracture, the displacement being minimal in four, but sufficient to warrant reduction in five. All the patients were women: it is notable that the sex distribution recorded in the literature is 60 per cent female and 40 per cent male. Six patients were over fifty years of age; the youngest was twenty-three and the oldest sixty-four. McMaster (1932) stated that although the condition can occur at any age and has been recorded at fourteen years, it is more common after the age of thirty. The interval between the fracture and the tendon rupture varied from four weeks to one year, with an average of eleven weeks. Suture was undertaken from one week to five months after the rupture. Only three patients had the prodromal symptoms of swelling over the radial side of the back of the wrist or of pain in this area radiating into the thumb. In several patients the tendon "snapped" suddenly.

TABLE I

ANALYSIS OF NINE CASES OF SPONTANEOUS RUPTURE OF EXTENSOR POLLICIS LONGUS TENDON

<table>
<thead>
<tr>
<th>Case</th>
<th>Occupation</th>
<th>Age</th>
<th>Sex</th>
<th>Side</th>
<th>Reduc-</th>
<th>Time</th>
<th>Prodromal</th>
<th>Delay</th>
<th>Residual</th>
<th>Suture</th>
<th>Follow-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>tion</td>
<td>after</td>
<td>symptoms</td>
<td>till</td>
<td>gap</td>
<td>removed</td>
<td>up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>of</td>
<td>fracture</td>
<td></td>
<td>sutu-</td>
<td>in</td>
<td>later</td>
<td>(years)</td>
</tr>
<tr>
<td>1</td>
<td>Violinist</td>
<td>63</td>
<td>L</td>
<td>No</td>
<td>8</td>
<td>—</td>
<td>20</td>
<td></td>
<td>7⁄6</td>
<td>No</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Housewife</td>
<td>35</td>
<td>R</td>
<td>Yes</td>
<td>5</td>
<td>Pain</td>
<td>3</td>
<td>1⁄3</td>
<td>No</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Housewife</td>
<td>57</td>
<td>R</td>
<td>No</td>
<td>4</td>
<td>—</td>
<td>4</td>
<td>1⁄3</td>
<td>Yes</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Housewife</td>
<td>23</td>
<td>L</td>
<td>Yes</td>
<td>8</td>
<td>—</td>
<td>4</td>
<td>1⁄3</td>
<td>Yes</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Housewife</td>
<td>63</td>
<td>L</td>
<td>No</td>
<td>4</td>
<td>—</td>
<td>12</td>
<td>1⁄3</td>
<td>Yes</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Housewife</td>
<td>54</td>
<td>L</td>
<td>Yes</td>
<td>6</td>
<td>—</td>
<td>2</td>
<td>1⁄3</td>
<td>Yes</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Manageress</td>
<td>44</td>
<td>L</td>
<td>No</td>
<td>6</td>
<td>Pain</td>
<td>2</td>
<td>1⁄3</td>
<td>No</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Typist</td>
<td>34</td>
<td>R</td>
<td>Yes</td>
<td>52</td>
<td>—</td>
<td>1</td>
<td>1⁄3</td>
<td>No</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Clerk</td>
<td>64</td>
<td>R</td>
<td>Yes</td>
<td>7</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>—</td>
<td>No</td>
<td>1</td>
</tr>
</tbody>
</table>

* Paper read at the 1949 Spring Meeting of the British Orthopaedic Association.
while they were doing a simple movement requiring no undue exertion of the thumb—for example, putting on a baby's napkin or brushing the hair. The typical clinical appearance is shown in Figure 1.

![Figure 1](image)

**Figure 1**
Spontaneous rupture of the long extensor tendon. There is loss of extension at the interphalangeal joint and loss of full extension at the metacarpo-phalangeal joint.

**PATHOLOGY**

A normal tendon is very strong; when subjected to excessive strain it will usually avulse bone or periosteum at its insertion, or rupture at the musculo-tendinous junction, rather than rupture in its own length. Spontaneous or pathological rupture occurs in tendons that are abnormal either because of disease such as tuberculous tenosynovitis, or of trauma, for example the repeated minor injuries of "drummer's palsy." The tendon that ruptures after a fracture of the lower end of the radius is likewise abnormal. Kleinschmidt (1929) considered that an incomplete tear was caused by a fragment of bone, but that in most cases this healed during the period that the wrist was immobilised; in the few cases in which healing was defective the tendon suddenly gave way at the weak area by sudden contraction of the muscle. But rupture of the tendon has often occurred in patients with so little disturbance of the bone surface that direct laceration of the tendon must have been improbable. Axhausen (1925) considered that friction over a sharp fragment of bone in the radial groove resulted in gradual fraying of the tendon. But the findings at operation do not support this hypothesis, for there is often no roughness of the groove and no fraying of the ruptured tendon ends. The most generally accepted theory is that suggested by Weigeldt (1914) and by Hauck (1923). They believed that tearing of the mesotendon at the time of the initial injury interferes with the blood supply to the tendon (it in any case decreases after the age of twenty-five) and so causes avascular necrosis; a sudden muscle contraction on the weakened tendon then causes the rupture. Operative findings lend support to this theory, for the tendon, particularly the proximal end, appears swollen, yellowish and bruised. Further, in a personal case one of the tendons of the extensor digitorum, although not ruptured, presented similar appearances even though it was well away from the fracture of the radius. In another case the ruptured tendon appeared to have been drawn out into a long, thin, smooth strip not unlike a
piece of stretched chewing gum, and suggesting that gradual softening and elongation had taken place. Microscopic section of the elongated tissue showed evidence of necrosis of the fibres with thrombosis of the capillary vessels within the tendon (Fig. 2).

**TREATMENT**

The treatment of the condition is operative; conservative measures are useless. The double function of the extensor pollicis longus tendon is to extend the interphalangeal joint and more important, to elevate the thumb as a whole, as in grasping; to be successful, any reconstructive operation must restore both functions. In the past there have been isolated instances of direct suture of the tendon but in most cases tendon transplantation has been undertaken. 1) The distal end of the ruptured tendon has been inserted into the tendons of the extensor pollicis brevis and abductor pollicis longus. This restores active extension of the interphalangeal joint but fails to restore extension of the thumb as a whole. 2) The tendon of extensor carpi radialis longior has been transferred to the distal end of the ruptured tendon. Again there has often been inability to lift the thumb completely, because of the inadequate excursion of the transplanted tendon. 3) Transfer of the extensor indicis proprius has given satisfactory results regarding the thumb but at the cost of some permanent weakness of the index finger. 4) A free tendon graft has been used with varying success.

The author believes that the tendon can always be sutured with success, even after an interval as long as five months between rupture and suture. The operation is simple and the method has the advantage that the anatomy is restored almost to normal without interference with any other tendon.

**Technique of operation**—The distal end of the ruptured tendon is easily found just distal to the radius and is mobilised for a distance of one and a half inches. The groove previously occupied by the tendon is examined. Within it is found a thin strip of tissue which is preserved carefully and gently pulled upon; it leads the surgeon to the proximal end of the ruptured tendon which may have become adherent either to the radius well above the site of fracture, or to one of the tendons of extensor digitorum. The proximal end is mobilised up to the musculo-tendinous junction (Fig. 3). A suture of strong nylon (number 6) is threaded at each end on to a straight needle and is inserted into the proximal part of the tendon in a criss-cross manner, starting at least one inch from the ruptured end. The nylon suture crosses itself in the substance of the tendon and emerges on the ruptured surface. It is then passed into the substance of the distal stump of the tendon as a mattress suture emerging fully one inch beyond the point of rupture. The suture is drawn up firmly and tied under tension with the wrist joint and thumb in extension (Fig. 4). Only in one patient was it possible by this method to coapt the ruptured ends of the tendon; in the other eight cases there was a gap, usually about a quarter of an inch, despite the fact that the sutured tendon lay to the radial side of Lister’s tubercle. In one patient the gap was as great as three-quarters of an inch, and in another half an inch.
Fig. 3
Both ends of the tendon have been located and mobilised.

Fig. 4
The nylon suture has been inserted into the distal part of the tendon for a distance of 1 to 1½ inches and tied securely under tension with the thumb and wrist in dorsiflexion. Note the gap of a quarter of an inch between the tendon ends.
Case 1. Suture of the long extensor tendon of the left thumb. The interval between rupture and suture was five months. The residual gap was half an inch. The photographs show the result four years later.

Case 4. Suture of long extensor tendon of left thumb. The residual gap at operation was three-quarters of an inch. The suture has been removed. The photographs show the result two years later.
After suture of the skin a lightly padded plaster is applied which allows a few degrees of flexion-extension movement of the interphalangeal joint, sufficient to prevent adhesions between the tendon and surrounding structures. Three weeks later the plaster is removed and active movements are begun. With persuasion full mobility of the thumb is gradually regained without resorting to special physical treatment.

The nylon suture may give rise to a sinus several weeks after operation; on four occasions the stitch was removed three months or more after operation. Removal of the suture was simple and on each occasion it was found that the gap had filled in with fibrous tissue similar in thickness to the tendon.

RESULTS

In every case full function of the thumb has been regained. The first patient treated by the operation described has been observed for more than five years. Illustrative cases are shown in Figures 5 to 9.

REFERENCES


DISCUSSION BY MR R. J. FURLONG

(Contributed after the original reading of the Paper)

Mr Furlong said that he wished to comment only on the technique of operation and the results obtained. Like Mr Trevor, he had found end-to-end suture in continuity usually impossible in the type of case described. The use of a scaffolding of suture material to promote continuity by growth of fibrous tissue was ingenious; unless, however, there was meticulous end-to-end apposition of tendon, the suture line adhered firmly to surrounding tissue, even if this was paratenon and not fibrous sheath.

The excellent results shown in Table I had not yet been equalled by any other method. It was fortunate that even if adherence should occur—a tenodesis, in fact—apparent active extension of the terminal thumb joint could take place by flexion at the wrist. This action would bear most of the hall-marks of perfect function and would be satisfactory to the patient.

A parallel could be found in the chimpanzee. In this animal the flexor longus pollicis tendon is attached to the lower end of the radius, there being no specific muscle. Grasping is achieved by dorsiflexion of the wrist, thereby flexing the tip of the thumb against the fingers. This arrangement works well; the chimpanzee, though heavy, is arboreal. The thought that there is a comparable explanation for these excellent results must occur.

An alternative operation, favoured by some, has been to suture the extensor longus tendon to the extensor brevis where they lie close together over the metacarpal. By adjustment of tension, the insertion into the proximal phalanx was neutralised and the effective action of the brevis muscle was to extend the terminal phalanx. The new motor had not quite the desired excursion, but the system worked admirably, and was, of course, known to be the normal arrangement in some primates.

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