A STUDY OF THE ETIOLOGY OF deQUERVAIN'S DISEASE

by

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INTRODUCTION

deQuervain's diseases is a chronic, painful condition of the wrist, marked by thickened and narrowed tendon sheaths of the short extensor and long abductor of the thumb. Etiology, the subject under consideration in this study, is still a controversial issue.

The 1893 edition of Gray's Anatomy mentions: "The tendons of the extensor muscles of the thumb are liable to become strained and their sheaths inflammed ... in consequence of its often being caused by wringing clothes, it is known as washerwoman's sprain."[1] F. deQuervain reported five cases "About a Form of Chronic Tendovaginitis" in 1895. In 1898 Hoffman wrote of "A Common, Undescribed Affection of the Extensor Muscles of the Thumb."[3] Subsequent articles have described this disease by a variety of names: "radial styloiditis"[4], "chronic thecitis"[4], "peritendinitis"[5,6], "tenosynovitis"[7,8], "stenosing tendovaginitis"[9,10], and "hitch hiker's syndrome."[11]

Patients with deQuervain's disease complain of wrist pain and mechanical limitation of thumb motion. Physical findings include tenderness and swelling over the radial styloid process and a positive Finkelstein's test.[12] Treatment by surgical incision of the involved dorsal carpal ligament and tendon sheaths is usually successful. Microscopic examination of these tissues reveals a chronic, nonspecific inflammatory reaction involving the tendons, tendon sheaths, and dorsal carpal ligament.

REVIEW OF THE LITERATURE

A majority of authors state that deQuervain's disease may result from the chronic minor trauma which occurs with repeated movements of the extensor pollicis brevis and abductor pollicis longus tendons through the first dorsal compartment.[13, 14, 15, 16, 17, 18, 19, 20] These movements are produced by flexion and adduction of the thumb or by adduction of the hand, and are encountered in activities such as typewriting, flycasting, barbering, knitting, and piano playing.[11] Since these activities often precede symptoms of the disease, these authors presume trauma to be a likely etiology. Pathologic changes similar to those found in deQuervain's disease have been produced by mechanical, thermal, and electrical traumatization of the corresponding tendons in rabbits[12]; this experimental work supports the above ideas.

A number of writers believe stenosing tendovaginitis at the radial styloid process may be caused by a single injury[21,22,23,24,25], or by acute injury to a chronically traumatized wrist.[26, 27, 28, 29] Occasional reports of symptoms following acute trauma support these theories.

Many articles emphasize the anatomical variations discovered during surgery on patients with deQuervain's disease. Frequently a fibrous band separates the first dorsal compartment into two osseofibrous tunnels; this surgical finding has been suggested as an etiology.[30, 31, 32, 33] Multiple or aberrant tendon slips arising from the abductor pollicis longus or extensor pollicis brevis muscle bellies have been indicted by authors as an etiologic factor[34, 35, 36, 37, 38],

but investigators of cadaver anatomy have found that multiple tendons from these two muscle bellies are common and attribute no etiologic significance to this finding at surgery. (39, 40, 41, 42)

A few writers state the anatomical structure of the hand is at fault. (4, 8, 35, 43) The extensor pollicis brevis and abductor pollicis longus tendons are angulated sharply over the radial styloid producing constant trauma with movement. Since most women can adduct their hands to a greater degree than men, they further angulate these tendons and predispose them to greater trauma. This possibly explains the high incidence of stenosing tendovaginitis in women.

Other authors describe preexisting pathology such as gout, rheumatoid arthritis, habitual subluxation of the carpometacarpal joint, and fractures of the radial styloid or scaphoid terminating in deQuervain's disease. (44, 45, 46)

PROBLEM

Investigation of the etiology of deQuervain's disease is the content of this study. Friction is a probable factor in the production of this disease. Since increased tissue mass within the first dorsal compartment would increase friction during activity of the tendons, three anatomic variations in which this tissue mass is greater than normal were chosen for study.

MATERIAL AND METHOD

The anatomy found in 128 wrists of 64 cadavers chosen at random was compared with the anatomy in twelve wrists of twelve patients treated surgically for deQuervain's disease. The following anatomical features were examined in both the cadavers and surgical patients:

1. The presence or absence of a fibrous band separating the first dorsal compartment into a double tunnel.

2. The number of tendons arising from the extensor pollicis brevis and abductor pollicis longus muscle bellies.

3. The distance the most distal muscle fibers of the extensor pollicis brevis and abductor pollicis longus extend into the first dorsal compartment, if at all.

The skin was incised over the dorsum of the thumb at the level of the interphalangeal joint, and the incision was extended proximally eight or ten centimeters above the radial styloid process. (figure 1) The proximal border of the dorsal carpal ligament was identified, and the tendons of the abductor pollicis longus and extensor pollicis brevis were isolated. The dorsal carpal ligament was incised over the extensor pollicis brevis tendon, and the presence or absence of a division of the first dorsal compartment noted. The tendons of the abductor pollicis longus and extensor pollicis brevis were lifted from the tunnel or tunnels to determine the exact number of tendons arising from each muscle belly. The tendons were then replaced in their original position. The thumb was adducted and flexed until the thumb tip approximated the area overlying the head of the fifth metacarpal while the

remainder of the hand and wrist were held in the anatomical position. (figure 2) Three measurements were taken from the tip of the radial styloid process:(figure 3)

1. To the proximal border of the dorsal carpal ligament.

2. To the most distal extensor pollicis brevis muscle fibers as they inserted onto their tendon.

3. To the most distal abductor pollicis longus muscle fibers as they inserted onto their tendon.

A similar dissection was performed on twelve wrists of patients with surgically confirmed deQuervain's disease. The skin incision measured from three to five centimeters, and was centered over the radial styloid process.

OBSERVATIONS

Cadavers(table I)

In 55, or 43%, of the 128 cadavers, a fibrous band extending from the under surface of the extensor retinaculum to the periosteum over the radial styloid process divided the first dorsal compartment into two osseofibrous tunnels. When a double tunnel was present, the extensor pollicis brevis tendon (or tendons) occupied the posterior tunnel and the abductor pollicis longus tendon (or tendons) was found in the anterior tunnel.

In 120 wrists the extensor pollicis brevis muscle possessed tendons which were single. In three instances, or 2.3%, two tendons arose from the extensor pollicis brevis muscle. In five wrists, the extensor pollicis brevis muscle belly and tendon were replaced by a substantial ligament joining the distal border of the extensor retinaculum to the dorsal surface of the base of the proximal phalanx of the thumb. Two or more tendons originated from the abductor pollicis longus muscle in 122, or 95.3%, of 128 wrists; a single tendon was found in only six wrists, two tendons were seen in 49 wrists, three tendons were observed in 69 wrists, and four tendons were discovered in four wrists.(figure 4)

When the thumbs of the cadavers were held in sharp flexion and adduction and the remainder of the hand placed in the anatomical position, nine extensor pollicis brevis muscle bellies were found within the first dorsal compartment distances of 0.1 to 1.1 centimeters, with an average of 0.7 centimeters. In 114 wrists the most distal extensor pollicis brevis muscle belly fibers joined the tendon

0.0 to 3.9 centimeters, with an average of 0.9 centimeters, above the proximal border of the dorsal carpal ligament. Only one abductor pollicis longus muscle belly extended into the first dorsal compartment, and this a distance of only 0.1 centimeter. In 127 wrists the most distal abductor pollicis longus muscle belly fibers inserted onto the tendon 0.2 to 5.2 centimeters, with an average of 2.2 centimeters, above the proximal dorsal carpal ligament border. The muscle bellies of either the short extensor or the long abductor of the thumb extended into the first dorsal carpal tunnel in ten, or 7.9%, of 128 wrists.

Bilateral thickening and induration of the dorsal carpal ligaments and synovial sheaths of both the extensor pollicis brevis and abductor pollicis longus tendons was observed on one cadaver which exhibited the extensor pollicis brevis muscle bellies slipping into the first dorsal compartment bilaterally, 0.9 centimeters on the right and 1.1 centimeters on the left. These tendons were narrowed within the constricted tunnels and bulbously enlarged proximal to the tunnels. In another cadaver the extensor pollicis brevis muscle belly extended into the tunnel 1.1 centimeters on the left and 0.7 centimeters on the right, and a similar thickening of the dorsal carpal ligaments and tendon sheaths existed bilaterally although the tendons appeared normal. The muscle bellies extended less than 0.5 centimeters into the first dorsal compartment in six additional wrists, and no pathological changes of the dorsal carpal ligament, synovial sheaths, or tendons were present in these.

Surgical Patients (table II)

Of the twelve patients in this group, five, or 41.6%, revealed a division of the first dorsal compartment into two spaces. The extensor pollicis brevis and abductor pollicis longus tendons were located within these spaces similar to those in cadavers.

All tendons of the extensor pollicis brevis muscle bellies were present and single. Eleven, or 91.6%, of the twelve patients had multiple abductor pollicis longus tendons; a single tendon was present in one patient, two tendons were found in six patients, and three tendons were noted in five patients.

With the thumb in the flexed and adducted position, the extensor pollicis brevis muscle belly was found extending into the first dorsal compartment in eleven, or 91.6%, of the twelve patients. It gained entrance from 0.4 to 1.3 centimeters, with an average of 0.7 centimeters. In one wrist the most distal extensor pollicis brevis muscle fibers extended to the proximal dorsal carpal ligament border, but not into the first dorsal compartment. In two instances the long abductor of the thumb accompanied the short extensor into the first dorsal carpal tunnel, extending 0.2 and 0.3 centimeters. In the other ten patients the most distal abductor pollicis longus muscle belly fibers inserted onto the tendon 0.2 to 2.2 centimeters, with an average of 0.6 centimeters, above the proximal dorsal carpal ligament border.

SUMMARY AND CONCLUSIONS

1. A fibrous band separated the first dorsal compartment into two osseofibrous dorsal carpal tunnels in 43% of the cadaver wrists and in 41.6% of the wrists in those individuals with proven deQuervain's disease. (figure 5) The extensor pollicis brevis tendon was doubled in 2.3% of the cadaver wrists and was single in all the wrists of patients with deQuervain's disease. The abductor pollicis longus muscle exhibited two or more tendons in 95.3% of the cadaver wrists and in 91.6% of wrists in patients with stenosing tendovaginitis. (figure 6) Since all these percentage differences between the two groups are slight, it would seem unlikely the presence of a double tunnel or of multiple tendons arising from the short extensor or long abductor predispose to deQuervain's disease.

2. The distal muscle belly fibers of the extensor pollicis brevis and abductor pollicis longus slipped into the first dorsal carpal tunnel in 7.9% of cadaver wrists and in 91.6% of the wrists of surgical patients. (figure 7) Pathologic changes similar to those in deQuervain's disease were found bilaterally in two cadavers in which the muscle belly fibers of the extensor pollicis brevis extended into the first dorsal compartment. In surgical patients with known deQuervain's disease and cadavers with probable deQuervain's disease the short extensor muscle fibers slipped into the dorsal carpal tunnel an average of 0.7 centimeters; in normal wrists the short extensor muscle fibers joined their tendon an average of 0.8 centimeters above the proximal dorsal carpal ligament border.

Friction between the tendons and structures surrounding them is

a probable cause of this disease, and an increase in the intratunnel mass may result in friction. Edema or hypertrophy following acute trauma or excessive use of muscle fibers inserted distally onto their tendon would result in a greater intratunnel mass and thereby increase friction. Since a more distal insertion of the short extensor muscle fibers onto their tendon is found in a high percentage of wrists with known and probable deQuervain's and in a low percentage of normal wrists, this anomalous condition is likely a predisposing cause of deQuervain's disease.

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TABLE I

Cadaver	Wrist	Number of Abd. Poll. Long. Tendons	Number of Ext. Poll. Brev. Tendons	Number of Spaces in First Dorsal Compartment	Radial Styloid Tip - Proximal Border Dorsal Carpal Lig. Measurement	Radial Styloid Tip - Distal Abd. Poll. Long. Muscle Fiber Measurement	Radial Styloid Tip - Distal Ext. Poll. Brev. Muscle Fiber Measurement	Proximal Border Dorsal Carpal Lig. - Distal Abd. Poll. Long. Muscle Fiber Distance	Proximal Border Dorsal Carpal Lig. - Distal Ext. Poll. Brev. Muscle Fiber Distance	Distance Abd. Poll. Long. Extends into First Dorsal Compartment	Distance Ext. Poll. Brev. Extends into First Dorsal Compartment
1.	Right	3	2	1	2.2cm.	5.5cm.	2.5cm.	3.3cm.	0.3cm.		
	Left	2	1	1	2.1	5.2	2.8	3.1	0.7		
2.	Right	3	1	1	1.5	4.2	3.5	2.7	2.0		
	Left	3	1	2	2.3	6.1	4.0	3.8	1.7		
3.	Right	2	1	2	2.1	2.0	2.5	-0.1	0.4	0.1cm.	
	Left	2	1	2	1.4	2.8	4.5	1.4	3.1		
4.	Right	3	1	1	2.5	6.0	4.1	3.5	1.6		
	Left	3	1	1	2.6	4.1	3.5	1.5	0.9		
5.	Right	3	1	1	2.3	4.3	3.5	2.0	1.2		
	Left	2	1	1	2.2	3.5	3.4	1.3	1.2		
6.	Right	3	1	1	1.9	4.0	5.8	2.1	3.9		
	Left	2	1	1	2.2	4.4	3.4	2.2	1.2		
7.	Right	3	1	2	2.7	4.0	3.1	1.3	0.4		
	Left	2	1	1	3.5	4.2	3.5	0.7	0.0		
8.	Right	2	1	2	1.5	3.5	2.9	2.0	1.4		
	Left	3	1	2	2.2	3.4	3.2	1.2	1.0		
9.	Right	3	1	1	2.6	3.4	3.0	0.8	0.4		
	Left	4	1	1	1.1	3.3	2.2	2.2	1.1		
10.	Right	3	1	2	2.2	4.1	2.2	1.9	0.0		
	Left	4	1	1	2.6	4.2	2.6	1.6	0.0		
11.	Right	2	1	1	2.6	5.0	3.1	2.4	0.5		
	Left	2	1	1	2.3	5.7	4.7	3.4	2.4		
12.	Right	2	1	2	2.7	4.3	4.2	1.6	1.5		
	Left	3	1	2	1.6	4.9	4.2	3.3	2.6		

TABLE I (Continued)

13.	Right	2	1	2	1.9cm.	3.7cm.	2.6cm.	1.8cm.	0.7cm.	
	Left	1	1	2	2.1	4.4	2.9	2.3	0.8	
14.	Right	2	1	1	2.0	3.8	1.5	1.8	-0.5	0.5cm.
	Left	2	1	2	2.9	3.8	3.5	0.9	0.6	
15.	Right	3	1	2	2.3	4.6	2.7	2.3	0.4	
	Left	3	1	2	2.7	3.2	3.1	0.5	0.4	
16.	Right	2	1	1	2.0	3.1	2.4	1.1	0.4	
	Left	2	1	1	2.1	3.0	2.8	0.9	0.7	
17.	Right	3	2	2	1.3	3.3	1.8	2.0	0.5	
	Left	3	1	2	2.9	4.6	3.2	1.7	0.3	
18.	Right	2	1	2	3.0	5.5	3.4	2.5	0.4	
	Left	1	1	1	2.9	5.0	3.5	2.1	0.6	
19.	Right	3	1	1	2.5	2.7	1.8	0.2	-0.7	0.7
	Left	3	1	2	3.1	3.6	2.0	0.5	-1.1	1.1
20.	Right	2	1	1	2.0	4.6	3.1	2.6	1.1	
	Left	2	1	1	1.7	4.6	3.4	2.9	1.7	
21.	Right	4	1	1	2.0	4.5	2.1	2.5	0.1	
	Left	2		1	2.2	2.8		0.6		
22.	Right	3	1	1	1.7	4.3	3.6	2.6	1.9	
	Left	3	1	1	2.6	4.7	4.6	2.1	2.0	
23.	Right	3	1	2	1.9	5.2	2.5	3.3	0.6	
	Left	3	1	2	2.0	4.5	2.5	2.5	0.5	
24.	Right	3	1	2	2.0	5.5	4.1	3.5	2.1	
	Left	3	1	1	2.8	5.1	4.2	2.3	1.4	
25.	Right	3	1	2	2.3	4.4	2.3	2.1	0.0	
	Left	2	1	2	2.0	3.8	2.0	1.8	0.0	
26.	Right	3		1	2.6	3.0		0.4		
	Left	3		1	3.1	3.9		0.8		
27.	Right	1	1	1	1.9	4.6	2.1	2.7	0.2	
	Left	3	1	1	2.0	5.0	3.0	3.0	1.0	
28.	Right	1	1	1	2.2	4.1	2.9	1.9	0.7	
	Left	1	1	1	2.3	5.0	2.6	2.7	0.4	
29.	Right	2	1	1	1.3	3.2	2.0	1.9	0.7	
	Left	3	1	1	2.0	2.5	2.5	0.5	0.5	
30.	Right	2	1	2	1.5	5.2	3.0	3.7	1.5	
	Left	2	1	1	2.2	5.0	3.2	2.8	1.0	
31.	Right	2	1	1	1.8	3.3	2.2	1.5	0.4	
	Left	2	1	1	2.4	4.8	2.8	2.4	0.4	
32.	Right	3	1	1	2.0	5.3	2.7	3.3	0.7	
	Left	3	1	1	2.1	2.9	2.8	0.8	0.7	
33.	Right	2	1	1	2.0	3.6	2.6	1.6	0.6	
	Left	2	1	1	2.2	4.9	2.8	2.7	0.6	
34.	Right	3	1	1	2.1	3.8	2.4	1.7	0.3	
	Left	3	1	1	3.9	5.1	4.6	1.2	0.7	
35.	Right	2	1	2	2.7	5.4	3.6	2.7	0.9	
	Left	3	1	2	3.0	4.3	3.5	1.3	0.5	
36.	Right	3	1	1	2.1	3.5	2.7	1.4	0.6	
	Left	3	1	1	1.9	5.0	3.0	3.1	1.1	
37.	Right	2	1	2	2.8	5.7	4.5	2.9	1.7	
	Left	2	1	1	2.7	5.0	3.7	2.3	1.0	

TABLE I (Continued)

38.	Right	3	1	2	2.2cm.	3.3cm.	2.8cm.	1.1cm.	0.6cm.	
	Left	2	1	2	2.7	4.0	3.2	1.3	0.5	
39.	Right	3	1	2	4.0	4.8	4.3	0.8	0.3	
	Left	3	1	2	2.6	3.4	2.9	0.8	0.3	
40.	Right	3	1	2	2.3	2.9	1.4	0.6	-0.9	0.9cm.
	Left	2	1	1	2.4	2.9	1.3	0.5	-1.1	1.1
41.	Right	3	1	2	2.4	5.2	3.4	2.8	1.0	
	Left	3	1	2	2.3	6.1	4.1	3.8	1.8	
42.	Right	2	1	2	1.1	4.5	2.3	3.4	1.2	
	Left	3	1	2	1.3	5.2	2.7	3.9	1.4	
43.	Right	2	1	1	2.2	4.5	2.6	2.3	0.4	
	Left	2	1	1	2.3	5.0	2.8	2.7	0.5	
44.	Right	4	1	1	1.5	6.5	4.3	5.0	2.8	
	Left	3	1	1	1.8	7.0	3.5	5.2	1.7	
45.	Right	3	1	1	2.6	3.6	2.1	1.0	-0.5	0.5
	Left	3	1	1	2.7	5.4	3.6	2.7	0.9	
46.	Right	3	1	2	1.0	3.4	2.4	2.4	1.4	
	Left	3	1	2	2.2	3.3	3.3	1.1	1.1	
47.	Right	3	2	2	1.9	3.6	2.9	1.7	1.0	
	Left	2	1	1	1.7	4.6	2.5	2.9	0.8	
48.	Right	3	1	1	2.3	4.5	2.7	2.2	0.4	
	Left	3	1	2	2.5	5.2	2.9	2.7	0.4	
49.	Right	2	1	1	2.2	4.9	3.2	2.7	1.0	
	Left	2	1	2	2.7	5.1	3.4	2.4	0.7	
50.	Right	2	1	2	3.5	3.8	3.6	0.3	0.1	
	Left	2	1	2	1.6	4.0	3.2	2.4	1.6	
51.	Right	3	1	2	2.6	5.2	3.1	2.6	0.5	
	Left	3	1	1	2.4	4.5	3.0	2.1	0.6	
52.	Right	2	1	1	2.1	3.4	3.1	1.3	1.0	
	Left	3	1	1	2.1	4.7	2.9	2.6	0.8	
53.	Right	2	1	1	2.3	4.1	1.9	1.8	-0.4	0.4
	Left	2	1	1	2.4	5.4	1.9	3.0	-0.5	0.5
54.	Right	3	1	2	2.9	5.8	3.6	2.9	0.7	
	Left	3	1	1	2.1	6.1	3.1	4.0	1.0	
55.	Right	2	1	2	2.2	5.5	2.7	3.3	0.5	
	Left	3	1	2	1.9	5.6	3.5	3.7	1.6	
56.	Right	3	1	1	2.9	3.6	3.7	0.7	0.8	
	Left	3	1	1	2.4	3.1	2.9	0.7	0.5	
57.	Right	3		1	2.8	4.4		1.6		
	Left	3		1	2.3	4.6		2.3		
58.	Right	2	1	2	1.5	5.0	2.4	3.5	0.9	
	Left	2	1	1	1.9	3.4	2.3	1.5	0.4	
59.	Right	3	1	2	1.4	5.7	4.6	4.3	3.2	
	Left	3	1	2	2.5	5.9	2.9	3.4	0.4	
60.	Right	3	1	1	1.9	4.1	2.7	2.2	0.8	
	Left	3	1	1	1.9	2.9	2.3	1.0	0.4	
61.	Right	2	1	2	1.6	3.0	2.3	1.4	0.7	
	Left	2	1	2	1.9	4.5	2.3	2.6	0.4	

TABLE I (Continued)

62.	Right	3	1	1	2.1cm.	4.1cm.	2.4cm.	2.0cm.	0.3cm.	
	Left	3	1	1	2.3	4.8	2.2	2.5	-0.1	0.1cm.
63.	Right	1	1	2	1.8	4.6	2.9	2.8	1.1	
	Left	2	1	2	2.4	4.1	3.2	1.7	0.8	
64.	Right	3	1	2	2.1	4.8	2.9	2.7	0.8	
	Left	3	1	2	2.5	5.5	3.0	3.0	0.5	

TABLE II

Patient	Wrist	Number of Abd. Poll. Long. Tendons	Number of Ext. Poll. Brev. Tendons	Number of Spaces in First Dorsal Compartment	Radial Styloid Tip - Proximal Border Dorsal Carpal Lig. Measurement	Radial Styloid Tip - Distal Abd. Poll. Long. Muscle Fiber Measurement	Radial Styloid Tip - Distal Ext. Poll. Brev. Muscle Fiber Measurement	Proximal Border Dorsal Carpal Lig. - Distal Abd. Poll. Long. Muscle Fiber Distance	Proximal Border Dorsal Carpal Lig. - Distal Ext. Poll. Brev. Muscle Fiber Distance	Distance Abd. Poll. Long. Extends into First Dorsal Compartment	Distance Ext. Poll. Brev. Extends into First Dorsal Compartment
1. L.T.	Right	2	1	1	2.1cm.	2.3cm.	1.4cm.	0.2cm.	-0.7cm.		0.7cm.
2. L.S.	Right	2	1	2	3.4	3.2	2.1	-0.2	-1.3	0.2cm.	1.3
3. M.B.	Left	2	1	2	2.2	2.6	1.6	0.4	-0.6		0.6
4. N.T.	Left	1	1	1	1.6	2.4	1.2	0.8	-0.4		0.4
5. A.L.	Left	3	1	2	2.1	4.3	1.6	2.2	-0.5		0.5
6. M.E.	Left	2	1	1	2.9	3.3	2.3	0.4	-0.6		0.6
7. V.T.	Right	3	1	1	1.8	2.5	1.8	0.7	0.0		
8. J.E.	Left	3	1	2	2.4	2.6	1.4	0.2	-1.0		1.0
9. A.B.	Right	3	1	1	2.1	2.3	1.2	0.2	-0.9		0.9
10. J.N.	Left	2	1	2	2.4	2.1	1.6	-0.3	-0.8	0.3	0.8
11. P.C.	Left	2	1	1	1.9	2.5	1.2	0.6	-0.7		0.7
12. P.D.	Right	3	1	1	2.0	2.2	1.5	0.2	-0.5		0.5

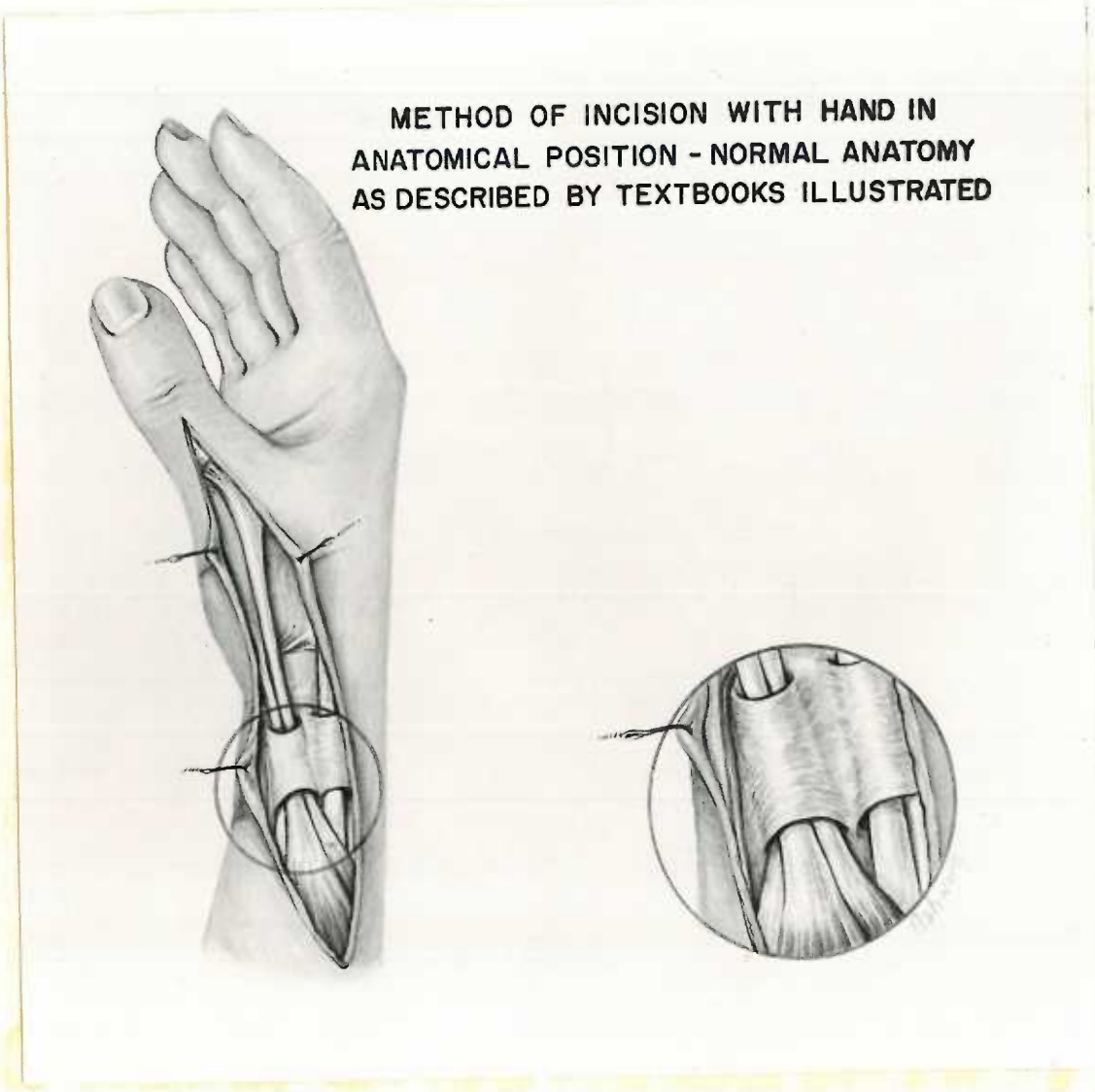
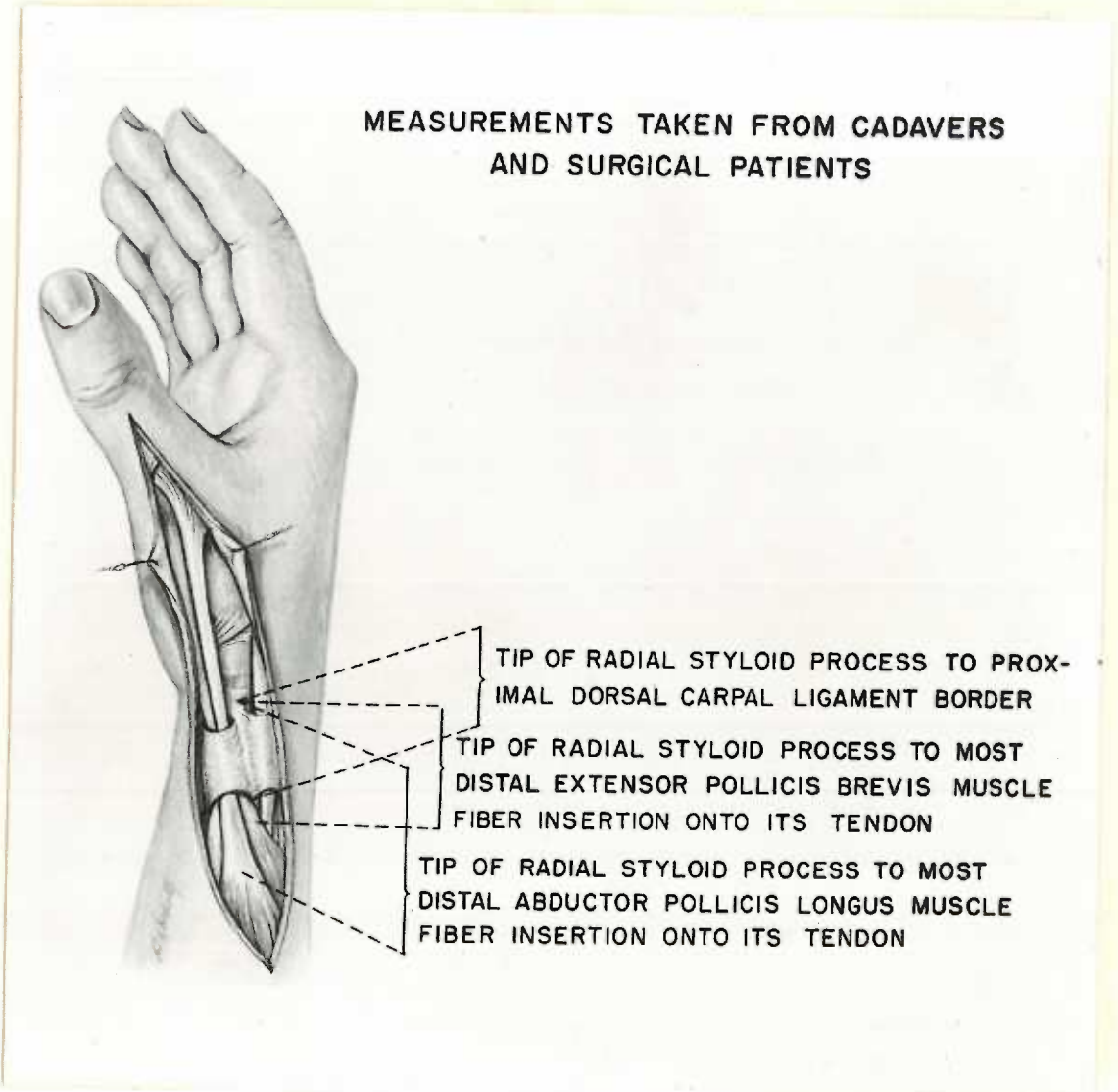

METHOD OF INCISION WITH HAND IN
ANATOMICAL POSITION - NORMAL ANATOMY
AS DESCRIBED BY TEXTBOOKS ILLUSTRATED

Figure 1

THUMB MAXIMALLY ADDUCTED AND FLEXED WITH REMAINDER OF HAND IN ANATOMICAL POSITION

Figure 2


MEASUREMENTS TAKEN FROM CADAVERS
AND SURGICAL PATIENTS
TIP OF RADIAL STYLOID PROCESS TO PROX-
IMAL DORSAL CARPAL LIGAMENT BORDER
TIP OF RADIAL STYLOID PROCESS TO MOST
DISTAL EXTENSOR POLLICIS BREVIS MUSCLE
FIBER INSERTION ONTO ITS TENDON
TIP OF RADIAL STYLOID PROCESS TO MOST
DISTAL ABDUCTOR POLLICIS LONGUS MUSCLE
FIBER INSERTION ONTO ITS TENDON

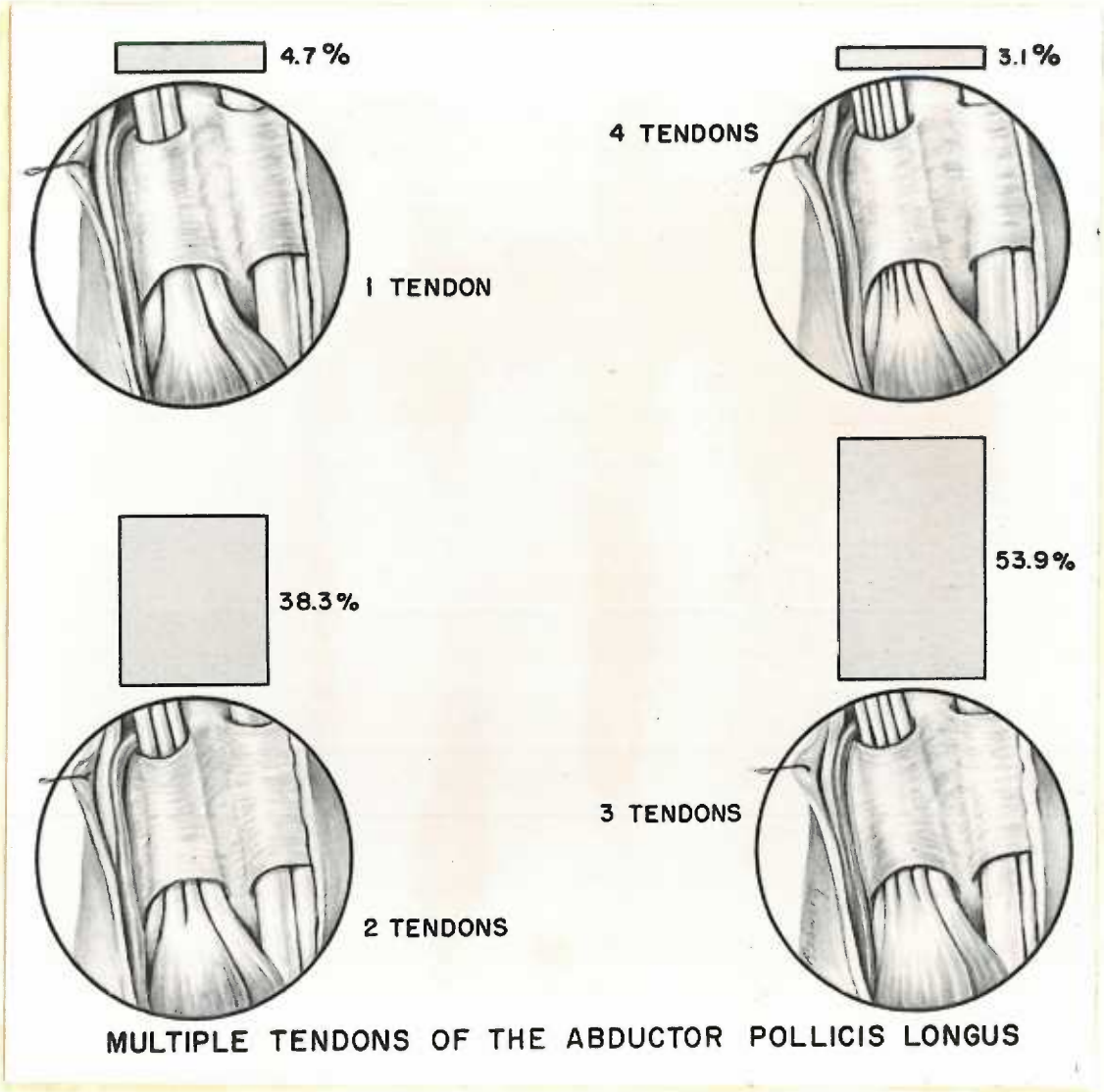

4.7%
1 TENDON
3.1%
4 TENDONS
38.3%
2 TENDONS
53.9%
3 TENDONS
MULTIPLE TENDONS OF THE ABDUCTOR POLLICIS LONGUS

Figure 4

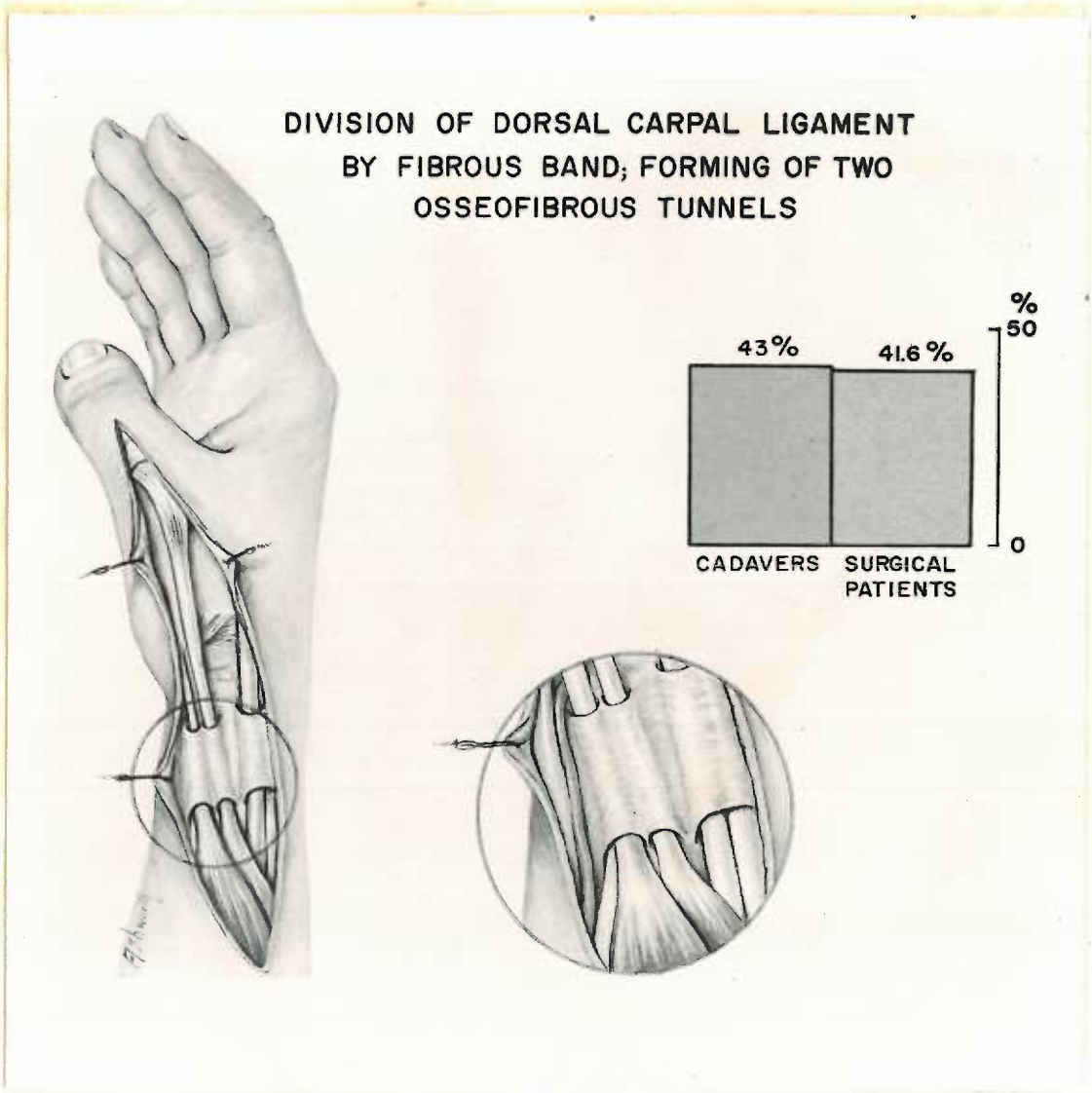

DIVISION OF DORSAL CARPAL LIGAMENT
BY FIBROUS BAND; FORMING OF TWO
OSSEOFIBROUS TUNNELS
%
50
43%
41.6%
0
CADAVERS
SURGICAL
PATIENTS

Figure 5

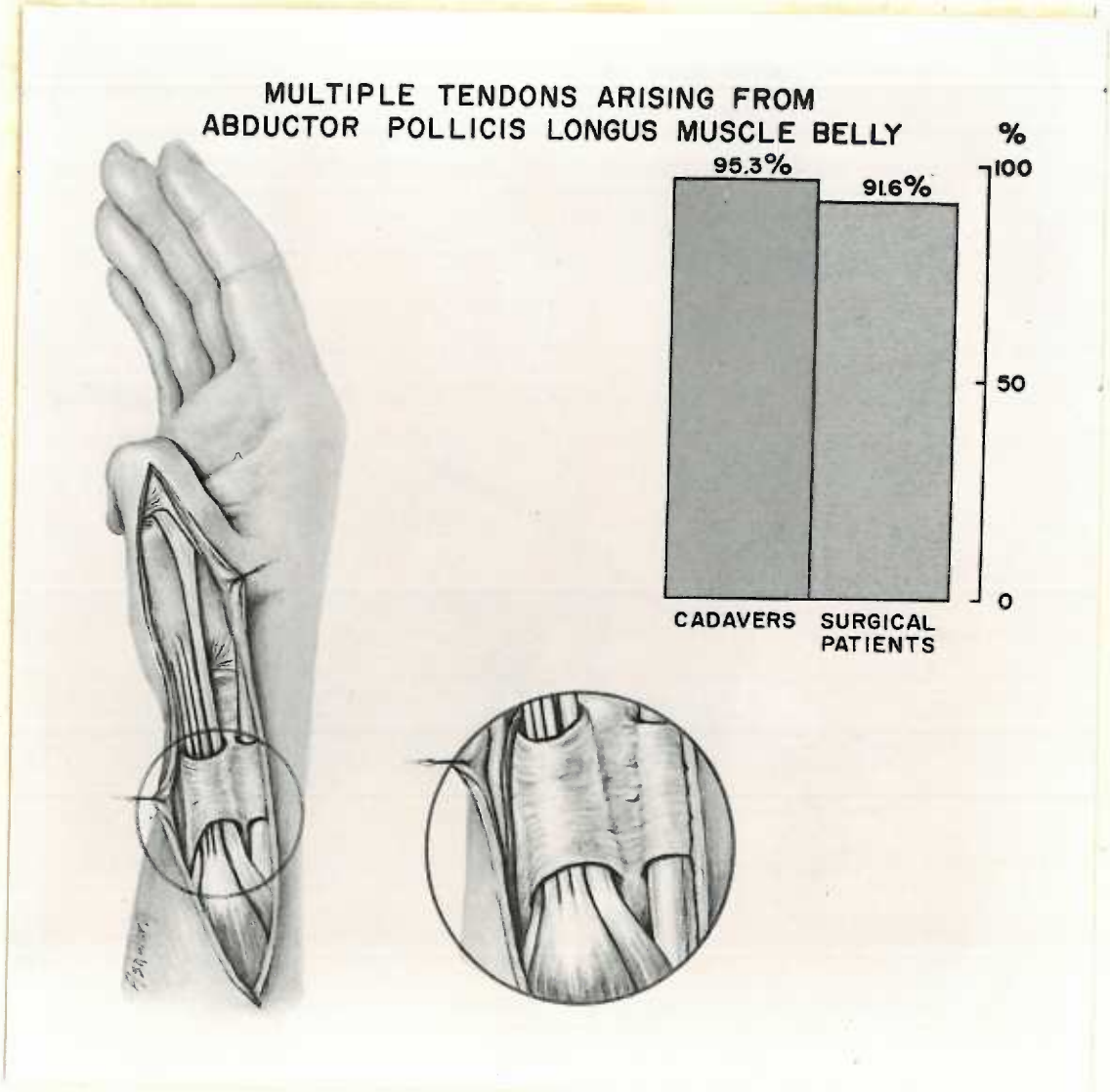

MULTIPLE TENDONS ARISING FROM
ABDUCTOR POLLICIS LONGUS MUSCLE BELLY
%
95.3%
91.6%
100
50
0
CADAVERS
SURGICAL PATIENTS

Figure 6

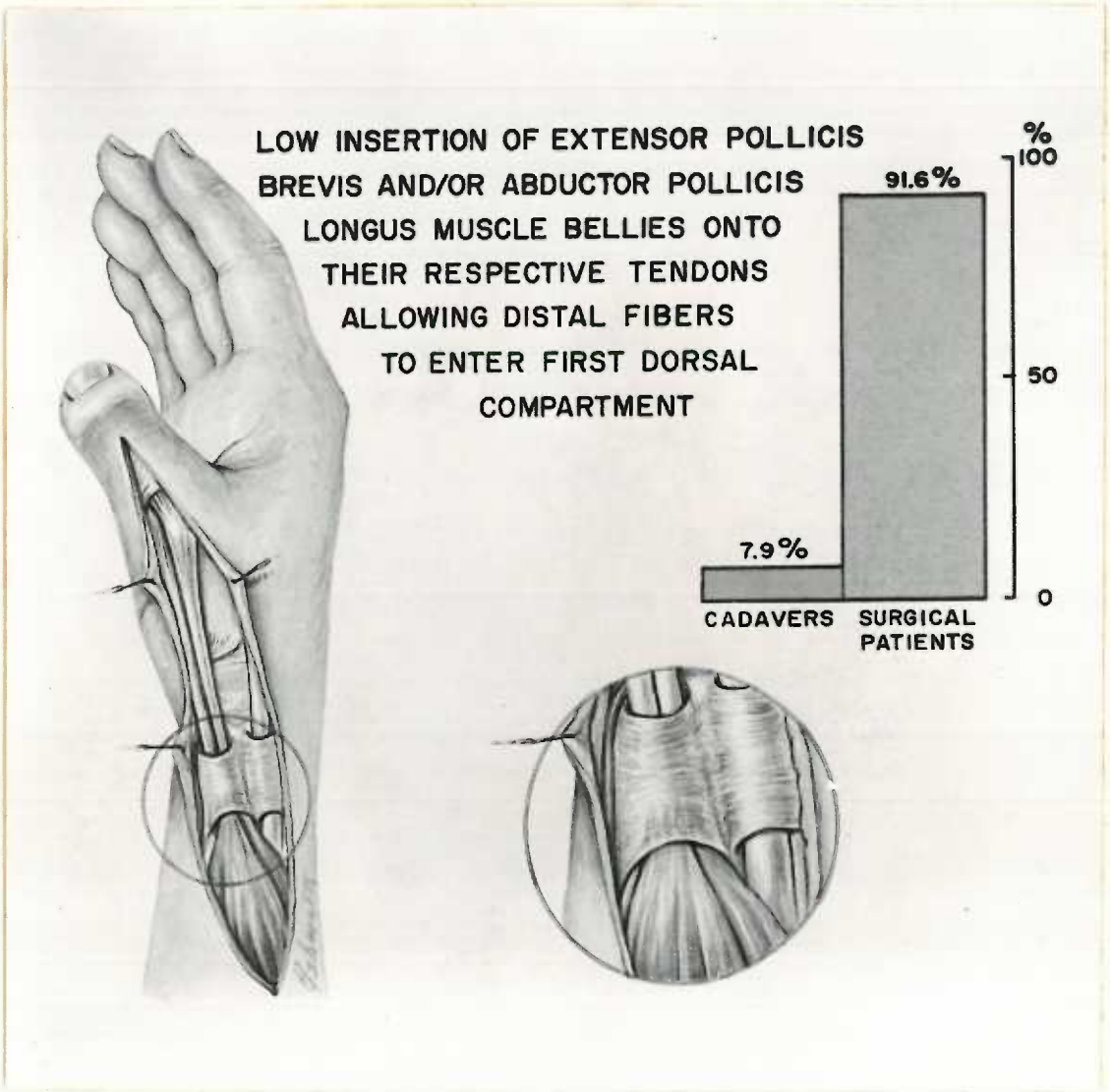

LOW INSERTION OF EXTENSOR POLLICIS BREVIS AND/OR ABDUCTOR POLLICIS LONGUS MUSCLE BELLIES ONTO THEIR RESPECTIVE TENDONS ALLOWING DISTAL FIBERS TO ENTER FIRST DORSAL COMPARTMENT
%
100
50
0
91.6%
7.9%
CADAVERS
SURGICAL PATIENTS

Figure 7