

## ONE-POINT PROXIMAL INJECTION TECHNIQUES FOR DE QUERVAIN'S DISEASE: A CADAVERIC STUDY

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### ABSTRACT

**Purpose:** To investigate the success rate of dye injection in the first extensor compartment of the wrist using the one-point proximal injection technique.

**Methods:** Thirty-seven wrists from 19 cadavers were included in the study. The skin overlying the first extensor compartment was removed. Methylene blue was injected directly in the first extensor compartment at a point 3 cm proximal to the palpated radial styloid. The first extensor compartment was explored to identify the dispersion of dye. The successful result was determined as diffusion of dye in both subcompartments of the APL and EPB. The anatomical variation of the first extensor compartment and the related structure were also investigated.

**Results:** A separated compartment was found in 20 of 37 dissected cadaveric wrists. Complete and incomplete septum was presented in 7 wrists and 13 wrists, respectively. The success rate of proximal injection technique in the septum group was 90%.

**Conclusions:** A higher success rate was observed when compared with the more distal single injection technique reported in a related study. The proximal injection technique may be used as an alternative method for steroid injection among patients with de Quervain's disease.

**Keywords :** one-point proximal injection techniques, de Quervain's disease, cadaveric study

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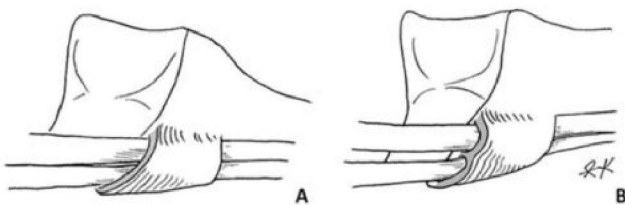
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**Introduction**

Stenosing tenosynovitis of the first extensor compartment of the wrist or de Quervain’s disease is one of the most common painful conditions found in repetitive hand users. The incident of the condition is predominant among female.<sup>(1,2)</sup> Friction between the tendons inside the first extensor compartment and its retinaculum seem to be the leading cause of the disease.<sup>(3)</sup>

Various types of conservative treatment are available, but steroid injection seems to be the most effective method for de Quervain’s disease.<sup>(4,5)</sup> However, presence of septum between the abductor pollicis longus (APL) and extensor pollicis brevis (EPB) inside the first extensor compartment is described as the major risk factor of injection failure

**Fig. 1.** <sup>(6-10)</sup>



**Fig. 1** The first extensor compartment without (A) and with intracompartmental septum (B).

Many studies have emphasized injection in both subcompartments of the APL and EPB can significantly increase the success rate of treatment.<sup>(8,11)</sup> According to an anatomic study, APL and EPB share a common muscle and vascular supply.<sup>(12)</sup> Moreover, the synovial sheath of the extensor tendon usually extends from the musculotendinous junction to the tendon insertion.<sup>(1)</sup>

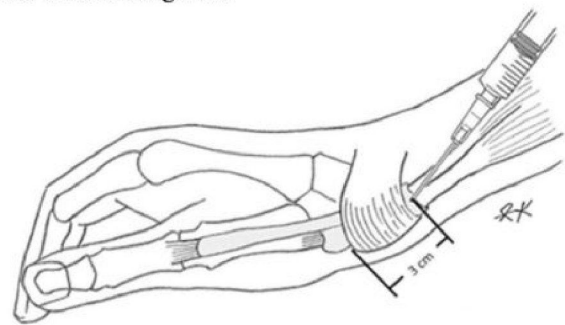
We believed that these two tendons might have a common or interconnected synovial sheath proximally that allowed the medication to spread in both subcompartments using the one-point injection technique at the proximal portion of the first extensor compartment.

**Methods**

Nineteen fresh cadavers (6 male and 13 female) from the Department of Anatomy, Mahidol University, were investigated. Any wrist that had deformity, injury or surgical scar in the area of the radial styloid was excluded from our study. The skin overlying the first extensor compartment was removed. A 25-gauge needle was used to inject 2 cc

of methylene blue dye, number#151B54, directly between the APL and EPB at a point 3 cm proximal to the palpated radial styloid **Fig. 2**. The needle was inserted at 45 degrees to the radial aspect of the forearm and directed distally.

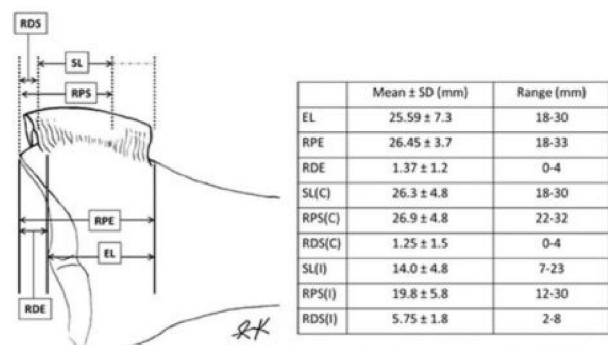
Then the first extensor compartment was explored to identify the dispersion of dye. In the case with separated compartments, the success result was determined as a diffusion of dye in both subcompartments. The relationship between the first extensor compartment and the superficial radial was investigated.



**Fig. 2** Proximal injection technique, the needle is placed directly between the abductor pollicis longus and extensor pollicis brevis at the point 3 cm proximal to the palpated radial styloid.

**Results**

Thirty-seven wrists from 19 cadavers were included in our study. One wrist with arteriovenous shunt in the distal forearm was excluded. The average age was 68.53±9.47 (range 37 to 87) years. The intracompartmental septum was found in 20 of 37 wrists (54%). The septation was complete in 8 wrists (40%) and incomplete in 12 wrists (60%). The details of anatomic findings are presented in **Fig. 3**.



**Fig. 3** The details of anatomic findings. EL = length of the extensor retinaculum, RPE = distance from the radial styloid to the proximal edge of extensor retinaculum, RDE = distance from the radial styloid to the distal edge of extensor retinaculum, SL = length of septum inside the first dorsal compartments, RPS = distance from the radial styloid to the proximal edge of septum inside the first extensor retinaculum, RDS = distance from the radial styloid to the distal of septum, (C) = complete septation, (I) = incomplete septation



In 20 wrists with intracompartmental septum, the methylene blue dye successfully diffused in both subcompartments in 18 wrists (90%) **Fig. 4**. The dye entered in only the APL subcompartment in 2 wrists (10%), while the complete septation was present in both. Moreover, the distance from the radial styloid to the proximal edge of the extensor retinaculum as well as the septum was 30 mm in one wrist and 32 mm in another.

The mean distance from the radial styloid to the point that the superficial radial nerve crosses the first extensor compartment was 26.59±3.1 mm (range 12 to 44 mm).



**Fig. 4** Diffusion of the dye into both subcompartment, abductor pollicis longus (arrow head) and extensor pollicis brevis (arrow), in the wrist with intracompartmental septum.

**Discussion**

Among the conservative treatments for de Quervain’s disease, corticosteroid seems to be the most effective method with a curative rate of 83 to 93%.<sup>(1, 4)</sup> Various anatomic studies have investigated the first extensor compartment of the wrist including multiple tendinous slips and variations of insertions of the APL and presence of the intracompartmental septum. Many studies have suggested that the intracompartmental septum is the main cause of failure of corticosteroid injection therapy for de Quervain’s disease.<sup>(6-10)</sup>

In related studies, the presence of intracompartmental septum varied from 32.1 to 77.5%. Among patients with separate compartments, the complete septation was presented in 39 to 71.7% of cases. We found a 54% incidence of intracompartmental septum and a 40% incidence of complete septation documented among patients with separated compartments, and these two values are in those reported ranges.<sup>(13-19)</sup> The anatomic variation of the first extensor compartment and the septum reported in related studies are summarized in **Table 1**.

Many studies have demonstrated that in the wrist with intracompartmental septum, the one-point injection

technique failed to deliver medication in both subcompartments and led to unsuccessful treatment.<sup>(8, 9, 11)</sup> Many injection techniques have been proposed to ensure that steroid injection can reach both subcompartments.

**Table 1.** The anatomic variation of the first extensor compartment and the septum reported in previous studies.

References	Operative finding	Cadaveric Study		Length of the first extensor compartment (cm)	
	Incidence (%)	Incidence (%)	Type of septum		
			Complete (%)		Incomplete (%)
Jackson et al (13)	67.5	40	71.7	28.3	
Leslie et al (14)		34			
Gonzalez et al (15)		47		20 (1.1-3.0)	
Mahakkanukrauh and Mahakkanukrauh (16)		77.5	39	61	
Shiraishi and Matsumura (17)		44.2	69.7	30.3	
Hazani et al (18)		34.7		21.9±3.7	
Motoura et al (19)		32.1	72.2	27.8	
Choi et al (20)	73		63.5*	36.5*	
The present study		54	40	60	25.59 ± 7.3

\*operative finding

Regarding the one-point, two-direction technique, the needle is first introduced and injects the medication in the tendon sheath at the level of the radial styloid; then the needle is redirected slightly dorsal aiming to inject the remain medication in a separate subcompartment of the extensor pollicis brevis.<sup>(1, 16)</sup>

Concerning the two-point technique, the steroid is introduced in a possible subcompartment of the APL and EPB from a different entry point.<sup>(8, 9)</sup>

Finally, regarding the ultrasound-guide injection technique, many studies have demonstrated that ultrasound can be used to identify the anatomical variation of the first extensor compartment including intracompartmental septum and confirm the corrected location of the needle before injecting corticosteroid in both subcompartments.<sup>(10, 20, 21)</sup>

Our technique, the one-point proximal injection technique, was based on the anatomic study.

Revol et al. found that the APL and EPB share a common vascular and muscular unit.<sup>(12)</sup> Wolfe suggested that the synovial sheath of the first extensor compartment usually extends from the musculotendinous junction to the insertion point.<sup>(1)</sup> Many studies have found that intracompartmental septum is usually confined in the distal portion of the first extensor retinaculum.<sup>(13, 14, 16, 20)</sup> We hypothesized that some interconnection exists between the synovial sheath of the APL and EPB, proximally.

In a wrist with intracompartmental septum, our success rate of 90% was higher than the one-point injection technique described in related studies. Mirzanli et al. injected acrylic dye into a subcompartment containing APL or EPB from the distal portion of the first extensor compartment in each cadaveric wrist with a separated compartment and found that the dye could enter only one subcompartment.<sup>(9)</sup>

Zingas et al. injected a mixture of corticosteroid and radiographic dye in the first dorsal compartment among 19 patients. They chose the interval between the APL and EPB at the distal edge of the first extensor compartment retinaculum as the entry point and found that dye diffused in both subcompartments in 5, not in 3 and only one subcompartment among 11 patients: 10 in the APL and 1 in the EPB subcompartment. They believed that small and deeply located subcompartments of the EPB were the cause of failure to place dye in its subcompartment. However, 7 of 11 patients with dye entering only one subcompartment gained relief. They explained the open-ended EPB subcompartment allowed the steroid to flow in from the APL subcompartment.<sup>(8)</sup>

Injury to the superficial radial nerve should involve the proximal injection technique. In our study, the nerve runs across the first extensor compartment at the point  $26.59 \pm 3.1$  mm (range 12 to 44 mm) proximal to the radial styloid. This finding was comparable to the study of Gurses et al.<sup>(22)</sup>

Several limitations can be found in our study. First, the sample size was small. The second limitation was lacking a comparison to the standard method. Third, our study was conducted using cadaveric wrists. Thickening of the first extensor retinaculum or narrowing of the compartment in the wrist with de Quervain's disease may have contributed to our failed proximal injection technique. We believe that a further well designed clinical trial study should be performed among patients with de Quervain's disease to confirm the usefulness of our technique.

## Conclusion

One-point proximal injection technique can be used as an optional method for injection corticosteroid to treat de Quervain's disease.

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