ORIGINAL ARTICLE

Impact of the Relationship between Extensor Pollicis Brevis Entrapment Test and Ultrasound Wrist Findings and Functional Outcomes in De Quervain's Disease

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Abstract

Introduction: Diagnostic methods for first extensor compartment tenosynovitis are widely accepted, yet identifying variations in its anatomy and addressing compartmental challenges remains elusive. The extensor pollicis brevis (EPB) entrapment test has emerged as a valuable diagnostic tool. Integrating clinical assessment with ultrasound examination improves diagnostic efficacy, highlighting the importance of evaluating functional outcomes.

Aim: To evaluate the connection between identified anatomical variations in patients with De Quervain's tenosynovitis and their functional outcomes and to ascertain how these variations are associated with the results of the EPB entrapment test and ultrasound wrist findings.

Materials and methods: A total of 60 participants showed positive Finkelstein test results for wrist pain, underwent EPB entrapment, and underwent ultrasound examinations by a surgeon and radiologist. Surgery was the definitive benchmark. The preoperative assessment included disability of arm, shoulder, and hand (DASH) scores and visual analog scale (VAS) pain measurements at 6 weeks, with postoperative evaluations at both 6 weeks and 6 months.

Results: Preoperatively (after 4 weeks), the QuickDASH score mean was 58.27%. Postoperative QuickDash score mean for 6 weeks and 6 months was 56.027 and 3.44%. The preoperative VAS score mean was 6.5. Postoperative VAS scores for 6 weeks and 6 months were 2.29 and 0.54. The *p*-value for DASH and VAS was highly significant, with a value of 0.0005.

Conclusion: Our study emphasizes the significance of detecting anatomical variations in De Quervain's disease. Employing reliable diagnostic methods enhances surgical precision, improves patient recovery and recurrence prevention, and optimizes disease management.

Keywords: De Quervain stenosing tenosynovitis, Muscular disease, Tendinitis, Tendon entrapment, Ultrasound.

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Introduction

De Quervain's disease, or tenosynovitis, manifests as inflammation in the initial extensor wrist compartment, housing the tendons of the abductor pollicis longus (APL) and extensor pollicis brevis (EPB). Recently highlighted in the research, anatomical variations[1,2] within this compartment suggest the potential existence of two compartments, each hosting a tendon with multiple slips. A fibrous septum, originating from a dorsal bony ridge over the radial styloid, divides these compartments. Noteworthy is that these variations, particularly in women, are associated with an elevated prevalence of De Quervain's disease, significantly impacting daily activities.

Dealing with De Quervain's disease often begins with conservative management. However, surgical intervention becomes essential in cases that persist and resist other forms of treatment. Despite these treatment options, documented evidence highlights treatment failure, often attributed to the failure to identify anatomical variations.[1,2] While initial insights into these variations were derived from cadaveric studies, modern diagnostic techniques have evolved, with ultrasound examinations emerging as a superior diagnostic tool. Recognizing these anatomical variations preoperatively becomes crucial for planning comprehensive surgical releases.[3] Nonetheless, clinical diagnosis remains a prerequisite, leading to the development of the EPB entrapment test,[4] and aiding in surgical planning (Table 1).

Functional outcome assessment, using tools like the disabilities of the arm, shoulder, and hand (DASH) score and the visual analog scale (VAS), has become a focal point in numerous studies.[5] These assessments are conducted both before and after surgical interventions to evaluate the efficacy of treatment. The primary goal of such studies is to improve functional outcomes in De Quervain's disease, with a particular emphasis on identifying

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Table 1: Patient occupation

Occupation	*Frequency*	*Percent (%)*
Housewife	29	48.3
Teacher	10	16.7
Clerk	1	1.7
Day labor	1	1.7
Electrician	1	1.7
Farmer	2	3.3
Plumber	1	1.7
Security	1	1.7
Servant	6	10.0
Software engineer	8	13.3

Table 2: Frequency and percentage of APL and EPB slips

Number of EPB slips (%)	*Number of APL slips (%)*
59 (98.3)	8 (13.3)
1 (1.7)	19 (31.7)
	16 (26.7)
	8 (13.3)
	5 (8.3)
	2 (3.3)
	1 (1.7)
	1 (1.7)

Table 3: Intracompartmental septum

Intracompartmental septum	*Absent (%)*	*Present (%)*
Surgery	3 (5)	57 (95)
Ultrasound	3 (5)	57 (95)

and understanding anatomical variations within the first extensor compartment (Table 2).[6]

This study seeks to contribute to the body of knowledge surrounding De Quervain's disease by exploring the impact of anatomical variations on functional outcomes (Table 3). Through a comprehensive assessment using the DASH score and VAS, we aim to better understand how identifying these variations can lead to improved patient outcomes and guide more effective treatment strategies (Tables 4 and 5).

Aims and Objective

To evaluate the connection between identified anatomical variations in patients with De Quervain's tenosynovitis and their functional outcomes and to ascertain how these variations associate with the results of the EPB entrapment test and ultrasound wrist findings.

Materials and Methods

This prospective observational study received approval from the Institutional Ethics Committee, and before participation, informed consent was obtained from all patients. The study period encompassed evaluations conducted between November 2020 and October 2022.

Patient Selection

The assessment comprised 60 wrists affected by De Quervain's disease, including individuals aged 18 or older with characteristic radial wrist pain and a clinically positive Finkelstein's test. Eligible participants had experienced nonsurgical treatment failure for over 4 weeks. Exclusion criteria involved prior first extensor compartment release and unwillingness to participate in the study.

Table 4: Reliability of EPB entrapment test

EPB entrapment test	
Sensitivity	75.4
Specificity	66.7
Positive predictive value	97.7
Negative predictive value	12.5
Accuracy	75.0

Table 5: QuickDASH score and VAS score for patients undergoing surgical release

	Mean ± standard deviation QuickDASH score	*Mean ± standard deviation VAS score*
Preoperatively (4 weeks of conservative Mx)	58.27 ± 12.53	6.59 ± 0.95
6 weeks postoperatively	5.69 ± 1.02	2.29 ± 0.86
6 months postoperatively	2.24 ± 0.88	0.54 ± 0.50
p-value (pairwise comparison)	0.0005	0.0005

p-value for change in QuickDASH and VAS score over time

Methodology

In this thorough study, 60 participants (10 males and 50 females) underwent a detailed examination for EPB) entrapment (Fig. 1) led by a skilled surgeon. Following this, each participant received a comprehensive wrist ultrasound (Fig. 2) conducted by an impartial radiologist, unaware of the clinical details. The surgeon remained intentionally uninformed, ensuring methodological rigor.[6]

Before the surgical phase, a thorough assessment was conducted involving the systematic documentation of DASH scores and VAS readings. The subsequent surgical release of the first extensor compartment, utilizing the wide-awake local anesthesia no tourniquet technique, was executed under local anesthesia. Significantly, the surgeon, remaining unaware of the ultrasound outcomes, adheres to the injection protocol outlined by Lalonde et al.[7] (Fig. 3).

Throughout the surgical procedure, a meticulous documentation process included noting anatomical structures, subcompartments, septa characteristics, extensor pollicis longus (EPL), and EPB tendon slips, and the presence of a bony crest over the radial styloid. Any observed anatomical variations during the surgery were methodically correlated with preoperative ultrasound findings, enriching the study with detailed insights into potential variabilities.[6]

In the postoperative phase, participants underwent thorough evaluations at the 6-week and 6-month marks, employing DASH and VAS scores to gauge functional status and pain levels. After a 4-week recovery period, patients were advised to resume normal activities, with the additional recommendation of using a postoperative thumb spica splint for the subsequent 4 weeks, ensuring optimal recovery and rehabilitation. This comprehensive methodology employed a multidimensional approach, integrating clinical assessments,

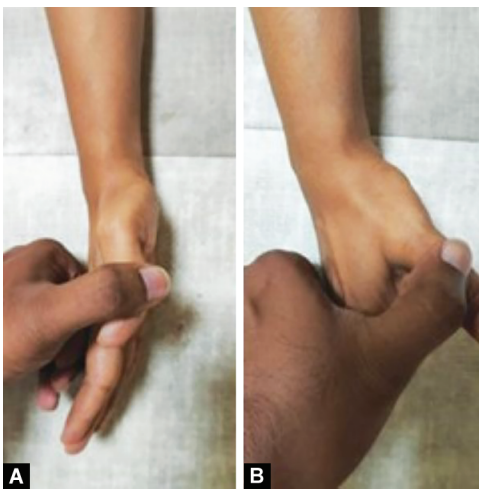
radiological procedures, surgical techniques, and postoperative evaluations to provide a robust exploration of EPB entrapment and its surgical management.

Statistical Analysis

Statistical analysis of the collected data involved the use of the Chi-squared test and Fisher's exact test to ascertain significance in categorical data.

Results

In this study encompassing 60 wrists from 59 patients (50 females and 10 males), with a mean age of 43.6 years, right-side dominance in 39 patients, and a majority of females engaged in homemaking (48.3%), participants had no history of hand traumas. Ultrasound revealed intracompartmental septa in 95% of wrists, with the EPB entrapment test positive in 73.3% and negative in 26.7%. Ultrasound



Figs 1A and B: EPB entrapment test—resisted thumb MCP extension and resisted thumb abduction

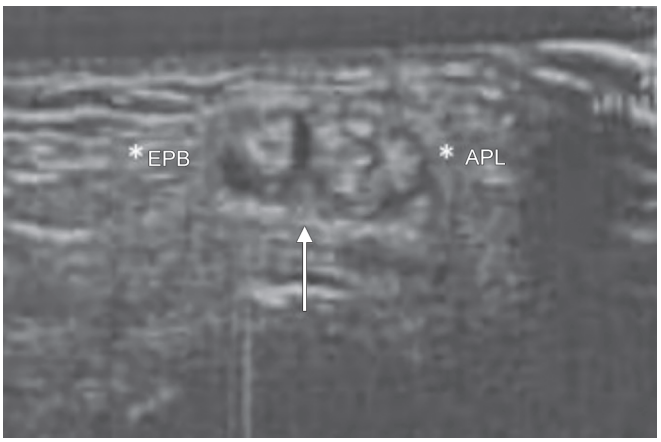
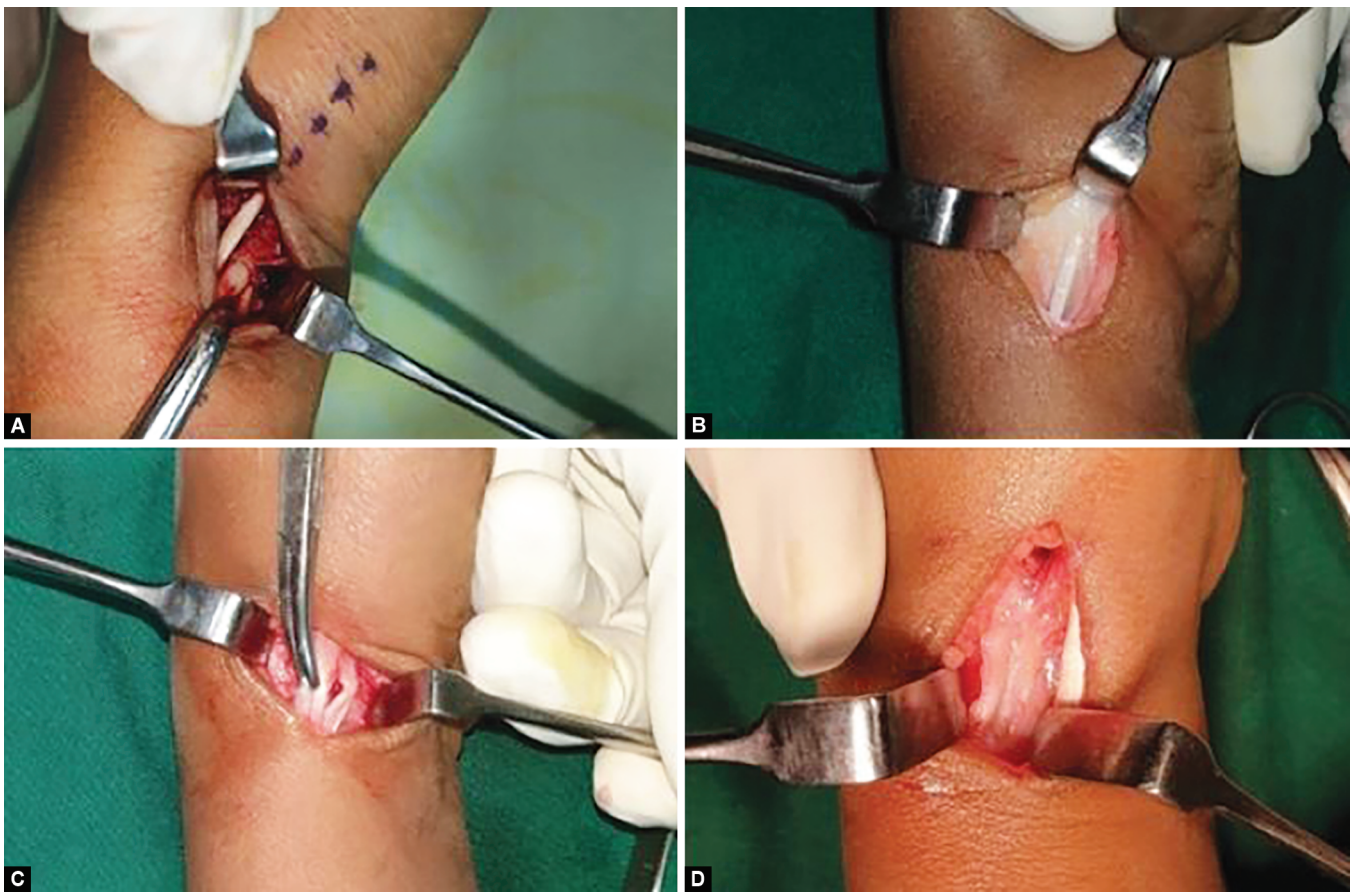


Fig. 2: Multiple APL tendon slips and single EPB tendon, each within two separate subcompartments, with a hypoechoic septa-like structure in between arising from a deep bony crest over the dorsal cortex of radial styloid, marked by a white arrow



Figs 3A to D: (A) EPB tendon in a complete subcompartment; (B) EPB tendon in a distal incomplete subcompartment; (C) Multiple tendon slips of APL; (D) Bony crest over the surface of radial styloid visualized after retracting the tendons away

identified a bony crest in 95% of wrists, correlating with positive EPB entrapment test results. However, ultrasound missed detecting a bony crest in three instances.

The EPB entrapment test yielded positivity in 44 wrists (73.3%) and negativity in 16 wrists (26.7%). Ultrasound identified intracompartmental septa in 95% of wrists, including 50 with distal incomplete septations and seven with complete septations. Interestingly, ultrasound erroneously identified an intracompartmental septum in a case with no actual septum between the two tendons.

Ultrasound recognized a bony crest in 95% of wrists, consistent with surgery validating a bony crest in all 60 wrists. Among the 60 surgically acknowledged bony crests, 36 were superficial, 22 were profound, and one exhibited a dual groove. Ultrasound overlooked one superficial bony crest.

Regarding APL tendon slips, variation ranged from one to eight, with the majority having triple tendon slips. APL tendon slips occurred individually in eight patients.

The EPB entrapment test showed an accuracy of 75.4% and specificity of 100%, with a positive predictive value of 97.7% and a negative predictive value of 12.5%. However, the correlation with surgical findings was not statistically significant ($p = 0.071$).

Ultrasound displayed a sensitivity of 97.4% in detecting intracompartmental septa but with a specificity of 50%. The positive predictive value for ultrasound was 97.4%, and the negative predictive value was 50%. Similar to the EPB entrapment test, the correlation between ultrasound findings and surgical results was not statistically significant ($p = 0.099$). Ultrasound demonstrated a sensitivity of 97.4% in identifying the bony crest, with three wrists where the presence of the crest was not recognized.

In terms of functional assessments, preoperative evaluation at 6 weeks revealed a mean DASH score of 58.27 and a mean VAS score of 6. Postoperative assessments at 6 weeks showed significant improvement, with a mean DASH score of 5.69 and a mean VAS score of 2. Further postoperative assessments at 6 months indicated continued improvement, with a mean DASH score of 2.24 and a mean VAS score of 0.5.

Comparing functional outcomes preoperatively at 6 weeks and postoperatively at 6 weeks and 6 months demonstrated statistical significance with a *p*-value of 0.0005.

Discussion

De Quervain's disease, a prevalent musculoskeletal ailment, exhibits varying prevalence rates of 0.5% in men and 1.3% in women.[8] Notably, treatment failure and recurrence rates, despite conservative and surgical approaches, have prompted a heightened focus on understanding anatomical variations within the first extensor compartment. Our research contributes uniquely to this realm. Unlike many studies relying on cadaveric samples,[8,9] our investigation explores the correlation between ultrasound examination and clinical findings, bridging a notable gap. Moreover, we establish a link between these diagnostic insights and surgical outcomes.[6] Functional assessments, utilizing DASH and VAS scores pre- and postsurgery, enrich our study. In clinical practice, Wu et al.[10] and Eichhoff's[11] tests, while common for diagnosis, lack sensitivity to anatomical variations. Our study introduces the EPB entrapment test, complementing clinical evaluations that discern the EPB tendon's presence in a separate compartment, refining diagnostic precision.

Our study explores the historical context, tracing the earliest records of anatomical alterations like additional tendons and fibrous septa back to Giles in 1960.[3] The evolutionary youthfulness of the compartment housing these tendons may explain the higher prevalence of anatomical variations. Despite ongoing research, the exact cause of De Quervain's disease remains elusive, with myxoid degeneration[12] being the most widely accepted etiology rather than an inflammatory reaction.

The relationship between the number of EPB and APL tendon slips, and the pathogenesis of De Quervain's disease remains uncertain. While the quantity of these slips does not seem directly linked, their location[9,13] is suspected to play a more significant role in disease development. Multiple slips in various sites, including the trapezium, abductor pollicis brevis muscle belly, opponents pollicis tendon, and the first carpometacarpal joint capsule, contribute to overcrowding and increased friction between tendons, contributing to the pathology.

Recent literature highlights the utility of ultrasound examination[14,15] in detecting anatomical variations, especially the intracompartmental septum, with reasonable diagnostic accuracy. Given the high failure rates of conservative methods, ultrasound-guided injections gain popularity as a nonoperative treatment.[16–18] However, surgical release of the first extensor compartment remains the gold standard.[19] Despite this, patient dissatisfaction rates postsurgery persist, often due to a lack of awareness about anatomical variations leading to incomplete release.

Our study introduces the concept of an osseous ridge, an elevation within the first extensor compartment's dorsal radial surface, giving rise to the intracompartmental septum.[6] The presence of this osseous ridge indirectly indicates subcompartmentalization.[6] Bridging the gap between clinical and ultrasound examinations and correlating them with surgical findings was our primary objective, coupled with functional assessments. We found a statistically significant improvement in functional outcomes (*p*-value of 0.0005), addressing the most common anatomical variation, distal incomplete septa, contributing to incomplete surgical release.[6]

Acknowledging limitations, including the cost of ultrasound examinations and patient refusal of surgical release, our nonrandomized study with a relatively small sample size suggests the need for further studies for a more comprehensive evaluation. In summary, our research underscores the importance of understanding anatomical variations in De Quervain's disease, enhancing diagnostic accuracy and guiding more effective surgical interventions, ultimately improving postoperative functional outcomes and patient satisfaction.

Conclusion

In conclusion, our research underscores the paramount importance of identifying anatomical variations in the context of De Quervain's disease. These variations not only significantly influence the prevalence of the condition but also play a crucial role in treatment outcomes. To address these challenges effectively, we emphasize the necessity of employing reliable diagnostic methods, such as the EPB entrapment test and ultrasound examination.

Our findings highlight that the combined utilization of these diagnostic approaches, particularly advantageous for nonhand surgeons, elevates the precision of preoperative planning, and intraoperative decision-making. This comprehensive strategy results in a more thorough and effective surgical release, ultimately diminishing the likelihood of treatment relapse.

Furthermore, our research introduces a functional dimension to the evaluation by utilizing tools like the DASH and VAS scores. Through assessing patients' functional outcomes before and after surgery, we establish the statistical significance of identifying anatomical variations preoperatively. This evidence emphasizes the positive impact on patient recovery and a diminished risk of recurrence, providing valuable insights for clinicians managing De Quervain's disease. In conclusion, our research underscores the paramount importance of identifying anatomical variations in the context of De Quervain's disease. These variations not only significantly influence the prevalence of the condition but also play a crucial role in treatment outcomes. To address these challenges effectively, we emphasize the necessity of employing reliable diagnostic methods, such as the EPB entrapment test and ultrasound examination.

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Clinical Significance

Essentially, our study emphasizes the pivotal role of identifying anatomical variations in enhancing the comprehensive care of De Quervain's disease. This not only improves patient outcomes but also significantly contributes to the success of the treatment strategy.

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