Ultrasonographic Evaluation of the Prevalence of an Intracompartmental Septum in Patients With de Quervain’s Disease

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Abstract

It has been reported that more patients with de Quervain’s disease who had undergone surgical treatment had a septated dorsal compartment than did normal cadavers. The purpose of this study was to sonographically evaluate the prevalence of an intracompartmental septum in patients with de Quervain’s disease and to compare the prevalence between groups categorized by sex, age, and peripartum status. The authors performed an ultrasonographic examination of 112 wrists from 103 patients with de Quervain’s disease. The prevalence of a septum-like structure in the first compartment was compared between men and women, between older (≥40 years) and younger (≤39 years) patients, and between pregnant or lactating women and other patients. The prevalence of intracompartmental septum in patients with de Quervain’s disease was 61.6% (69 of 112). Of the 69 wrists with an intracompartmental septum-like structure, 53 showed this structure completely through the level of the radial styloid, and 16 showed it partially on the level of the distal radial styloid. There was no significant difference between any 2 groups categorized by the patients’ demographics. The prevalence of intracompartmental septation in the patients with de Quervain’s disease was higher than the previously reported prevalence in cadavers and lower than that of patients who underwent surgery. This result was consistent with a previous report that patients with a septated dorsal compartment may be more at risk of contracting de Quervain’s disease and more prone to failure of nonoperative treatment. [Orthopedics. 2016; 39(2):112-116.]

De Quervain’s disease, a common pathology of the first dorsal compartment of the wrist, involves the abductor pollicis longus (APL) and extensor pollicis brevis (EPB) tendons. The presence of an intracompartmental septum between the APL and EPB tendons is an anatomic variation of the first dorsal compartment of the wrist. Previous studies have reported that more patients who had undergone surgical treatment for de Quervain’s disease had a septated dorsal compartment than did normal cadavers: 73% to 91% of the patients had an intracompartmental septum, compared with only 34% to 47% of the cadavers. Two studies that directly compared the prevalence of intracompartmental septation in cadavers and in patients with de Quervain’s disease who underwent surgery also reported a higher prevalence in the patients. In these studies, 58% to 67.5% of the patients with de Quervain’s disease had an intracompartmental septum, compared with only 37% to 40% of cadavers. Moreover, it has been suggested that patients with a septated dorsal compartment may be more prone to failure of nonsurgical treatment. Specifically, the presence of an EPB subcompartment has been suggested to be associated with refractory symptoms; however, it is unknown what percentage...
of patients who responded well to nonsurgical treatment had an intracompartmental septum and how septation of the dorsal compartment affects the pathophysiology of de Quervain’s disease.

Ultrasound allows for noninvasive visualization of soft tissues. When the first dorsal compartment was visualized on a transverse scan, the EPB and APL tendons were observed as round, hyperechogenic structures, within which the tendon fibers formed round arrays of closely packed, dot-like echoes.\textsuperscript{13} The extensor retinaculum appeared as a hypoechoic, bundle-shaped structure relative to the adjacent tendons, and the intracompartmental septum, if it was present, also appeared as a hypoechoic structure between the tendons. When ultrasonographic identification of the intracompartmental septum was verified in patients who then underwent surgery, good sensitivity and specificity were reported.\textsuperscript{13,14}

Previous case series and epidemiologic studies suggest that de Quervain’s disease is more common in women than in men\textsuperscript{11,15-17} and is more prevalent in older people (≥40 years).\textsuperscript{17} Pregnant or lactating women are overrepresented in patients with new onset of this disease.\textsuperscript{18-22}

The purpose of the current study was to sonographically evaluate the prevalence of septation of the first dorsal compartment in patients with de Quervain’s disease and to compare the prevalence between the groups categorized by sex, age, and peripartum status.

**Materials and Methods**

The authors’ institutional review board approved the study protocol. All patients were informed of the study’s aims and procedures and signed a consent form that included a description of the protocol. The authors sonographically evaluated consecutive patients admitted to the clinic with de Quervain’s disease from February 2011 to May 2015. The patients were diagnosed as having de Quervain’s disease if they met the following criteria:

1. Pain over the radial aspect of the wrist and tenderness on the radial styloid process, and
2. A positive Eichoff’s test (a provocative maneuver that causes pain with brisk ulnar deviation of the wrist while the thumb is clenched within the fist; not to be confused with the Finkelstein test).\textsuperscript{15}

The authors confirmed that no pain was elicited on palpation of the trapeziometacarpal, intercarpal, and radiocarpal joints or by axial compression of the thumb. They also confirmed an absence of focal tenderness proximal to the first dorsal compartment to exclude intersection syndrome.

Nine patients had de Quervain’s disease bilaterally. In total, 112 wrists in 103 patients were enrolled in the study (31 men and 72 women; mean age, 48.1±15.8 years [range, 18-81 years]). Four patients had noninsulin-dependent diabetes mellitus, 3 had hyperlipidemia, 1 had non-insulin-dependent diabetes mellitus and hyperlipidemia, and 1 had rheumatic arthritis. All patients with noninsulin-dependent diabetes mellitus had the disease well controlled with oral medication, exercise, and caloric restriction. Affected wrists comprised 55 right and 57 left wrists, and 59 dominant and 53 nondominant wrists. Ultrasonographic examination was performed at the time of the initial diagnosis of de Quervain’s disease.

The sonographic appearance of the first dorsal compartment was evaluated on transverse images. Patients sat with their hands on a rectangular table in neutral pronosupination with their wrist extended 5° to 10° and elbow flexed at 90°. The probe was applied perpendicularly to the first dorsal compartment of the distal forearm with minimal pressure. Identification of the APL and EPB tendons on the transverse image distal to the radial styloid process was initially confirmed by flexion and extension of the metacarpophalangeal and trapeziometacarpal joints of the thumb, respectively. Then the first dorsal compartment was examined by moving the probe proximally from the level at which the tip of the radial styloid process was initially visible on the dorsal aspect of the floor of the dorsal compartment, deep to the tendons, to the level at which the radial styloid process is just visible on the entire floor of the dorsal compartment, deep to the tendons. If a hypoechoic structure was visible between the APL and EPB tendons, it was classified as an intracompartmental septum-like structure (Figures 1-2). In this study, even if the hypoechoic structure was visible only in the distal part of the first dorsal compartment, it was considered an intracompartmental septum-like structure (Figure 3). Images were displayed to allow side-by-side comparison of the right and left hands.

![Figure 1: Sonographic images of the first dorsal compartment without an intracompartmental septum-like structure. The level at which the tip of the radial styloid process can initially be perceived on the dorsal aspect of the floor of the compartment, deep to the tendons (A), and the level at which the radial styloid process can just be visualized on the whole floor of the dorsal compartment, deep to the tendons (B), are shown. The extensor pollicis brevis and abductor pollicis longus tendons appear as if they were one tendon, and it is difficult to distinguish their individual boundaries. With the probe moving proximally from the carpus to the forearm, the tip of the radial styloid process appeared on the dorsal aspect of the floor of the dorsal compartment, deep to the tendons. At the more proximal level, the entire mass of tendons lays over the radial styloid process.](image-url)
To investigate the relationship between patient characteristics and subcompartmentalization of the first dorsal compartment, the prevalence of intracompartmental septum-like structures was compared between men and women, older (≥40 years) and younger (≤39 years) patients, and pregnant or lactating women and the other patients using chi-square tests. The comparison between men and women was performed in 2 different populations: (1) all patients and (2) the patients excluding pregnant or lactating women.

All sonographic studies were performed using software from the Avius ultrasound system (Hitachi-Medico Co, Tokyo, Japan). A linear-array 13.5-MHz transducer (EUP-L74M; contact area, 14×59 mm) or 17-MHz transducer (EUP-L75; contact area, 9×43 mm) was used. Tissue measurements were repeated twice on 10 randomly selected patients to ensure reproducibility of the calculated values. The maximum intraobserver error was 0.2 mm for the tendon and 0.1 mm for the extensor retinaculum. One senior hand surgeon (J.S.) with 13 years of experience in surgery and 2 years of experience in ultrasound analyzed all images.

RESULTS

Table 1 reports patient demographic data. There were 19 men and 44 women in the older age group, and 12 men and 28 women in the younger age group. In total, 69 (61.6%) of 112 wrists showed an intracompartmental septum-like structure. Of the 69 wrists with an intracompartmental septum-like structure, 53 (76.8%) showed this structure completely through the level of the radial styloid, and 16 (23.2%) showed it partially on the level of the distal radial styloid. There were no significant differences in the prevalence of dorsal compartment septation between any 2 groups categorized by the patients’ demographics (Table 2). No patients showed occult lesions such as ganglions of the first dorsal compartment of the wrist on any images.
**DISCUSSION**

The results of this study showed a 61.6% (69 of 112) prevalence of intracompartmental septum in patients with de Quervain’s disease, which is higher than the previously reported prevalence in cadavers and lower than that of patients who underwent surgery. There was no significant difference in the prevalence between the groups categorized by sex, age, or peripartum status.

This study has several limitations. First, the same surgeon performed all physical and sonographic examinations. Second, the authors did not validate their findings; the presence or absence of a septum-like structure on ultrasonographic examination was not confirmed to be a true anatomic septum. Although desirable, such validation is impractical in patients who do not undergo surgical treatment; however, the authors believe that their results are reliable based on previous reports of good correlations between the sonographic appearance and anatomy of the first dorsal compartment. Third, there was no control group in this study. Although the authors did not compare the prevalence of intracompartmental septation between the patients with de Quervain’s disease and healthy persons, the strengths of this study include the investigation of the prevalence in all patients diagnosed with de Quervain’s disease and not only in the patients who underwent surgery.

Intracompartmental septum has been reported to be present more often in patients with de Quervain’s disease who underwent surgery than in normal cadavers. An unreleased EPB subcompartment has been reported to result in residual pain after surgery. Leslie et al. and Yuasa and Kiyoshige reported that only the release of the EPB compartment resulted in complete pain relief in 16 patients. The reason why the EPB subcompartment caused intractable symptoms has not been determined; however, given its clinical relevance, it seems important to determine whether the patient with de Quervain’s disease has an intracompartmental septum because this may influence the prognosis for the disease. Previous cadaver studies have reported that subcompartmentalization of the first dorsal compartment is not always complete and sometimes the septum only partially divides the compartment. González et al. defined “a true septum” as one that extended at least half the length of the compartment, whereas a 0.5-cm–long septum was counted among septations in the study by Leslie et al. Shiraishi and Matsumura divided septations of the first dorsal compartment into 4 categories and found a complete septum in 30.8% and an incomplete septum separating the peripheral segment in 13.2% of 159 hands from 80 cadavers. Meanwhile, the current study’s result showed a complete septum-like structure in 47.3% (53 of 112) and an incomplete septum-like structure in 14.3% (16 of 112) of the patients with de Quervain’s disease.

Previous studies have shown good correlation between the sonographic appearance of the first dorsal compartment and actual subcompartmentalization found during surgery, with a few false-positive cases. Kwon et al. described a hypoechogetic area between the APL and EPB tendons in the distal first dorsal compartment that did not necessarily indicate the presence of a septum, and the location of the hypoechogetic distal radius just below these tendons is appropriate to ensure the septum. Choi et al. reported 4 instances of incomplete distal subcompartmentalization in 15 wrists during surgery; 3 out of 4 of these were identified as lacking complete subcompartmentalization during the preoperative ultrasound examination.

Epidemiologic analyses have reported a higher incidence of de Quervain’s disease.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Prevalence of Intracompartmental Septum-Like Structures on Ultrasonographic Examination of Affected Wrists</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Group</td>
<td>Intracompartmental Septum-Like Structure, No.</td>
</tr>
<tr>
<td>Men (n=35)</td>
<td></td>
</tr>
<tr>
<td>Women (including pregnant or lactating women) (n=77)</td>
<td></td>
</tr>
<tr>
<td>Men (n=35)</td>
<td></td>
</tr>
<tr>
<td>Women (excluding pregnant or lactating women) (n=57)</td>
<td></td>
</tr>
<tr>
<td>Pregnant or lactating women (n=20)</td>
<td></td>
</tr>
<tr>
<td>Other patients (n=92)</td>
<td></td>
</tr>
<tr>
<td>Older patients (≥40 y) (n=67)</td>
<td></td>
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<tr>
<td>Younger patients (≤39 y) (n=45)</td>
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</tbody>
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Numbers in parentheses refer to the number of wrists that showed an intracompartmental septum-like structure completely through the level of the radial styloid/number of wrists that showed this structure partially on the level of the distal radial styloid. Statistical significance was determined by the chi-square independence test in all comparisons between 2 groups.
disease in women, patients who are black, and older patients (≥ 20 years). The incidence of de Quervain’s disease in women is 3 to 6 times greater than in men. Pregnancy and lactation are also considered to be risk factors for this disease. The pathophysiology underlying the higher incidence of de Quervain’s disease in women, especially peripartum women, is not fully understood. It has been speculated that the onset of de Quervain’s disease is associated with certain hormones in peripartum women, especially prolactin, which begins to rise in the eighth week of pregnancy, peaks at 10 times the normal level, and decreases to normal concentrations at 3 to 4 months after delivery in lactating women. In the current study, the authors compared the prevalence of intracompartmental septation between the groups categorized by sex, age, and peripartum status because, if there is a significant difference, it may help to resolve the pathophysiology of de Quervain’s disease in each group. However, no significant difference in the prevalence was found between these groups.

**Conclusion**

The prevalence of intracompartmental septation in patients with de Quervain’s disease was sonographically evaluated. The prevalence was higher than the previously reported prevalence in cadavers and lower than that of patients who underwent surgery. This result was consistent with a previous report that patients with a separted dorsal compartment may be more at risk of contracting de Quervain’s disease and more prone to failure of nonoperative treatment.

**References**