

DIAGNOSTIC ACCURACY OF ULTRASONOGRAPHY IN THE DETECTION OF CLINICALLY DIAGNOSED CASES OF DEQUERVAIN'S TENOSYNOVITIS IN COMPARISON WITH INTRAOPERATIVE FINDINGS AS GOLD STANDARD

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ABSTRACT

Background: De Quervain's tenosynovitis is a common inflammatory condition affecting the first dorsal compartment of the wrist, leading to pain and functional impairment. Ultrasonography (USG) is increasingly being used as a diagnostic modality due to its non-invasive nature, availability, and real-time imaging capabilities. However, its diagnostic accuracy in comparison to intraoperative findings, which serve as the gold standard, remains to be clearly established. **Aim:** The objective of this research is to evaluate the diagnostic accuracy of ultrasonography in detecting De Quervain's tenosynovitis, a condition characterized by inflammation of the first dorsal compartment of the wrist. The study aims to compare ultrasonographic findings with intraoperative observations, which serve as the gold standard, to determine the sensitivity, specificity, positive predictive value, and negative predictive value of ultrasonography in diagnosing this condition. By establishing its reliability, the study seeks to assess the utility of ultrasonography as a non-invasive diagnostic tool for De Quervain's tenosynovitis. **Materials and Methods:** This hospital-based cross-sectional study will be conducted in the Department of Radio-diagnosis at Nilratan Sirkar Medical College & Hospital, Kolkata, from January 2023 to June 2024. The study population will consist of patients presenting to the Department of Orthopaedic Surgery with a clinical diagnosis of De Quervain's tenosynovitis who require surgical management and are referred to the Department of Radiodiagnosis for imaging. A total of 60 patients will be included in the study to evaluate imaging findings and their correlation with clinical and surgical outcomes. **Result:** The study analyzed intraoperative findings of De Quervain's Tenosynovitis based on laterality and ultrasonographic correlation. No significant association was found between laterality and intraoperative confirmation ($p = 0.3942$). However, ultrasonographic features, including APL thickening, EPB involvement, synovial sheath abnormalities, and extensor retinaculum changes, showed significant correlations with intraoperative findings ($p < 0.05$), except for the intracompartmental septum ($p = 0.4324$). Intraoperative presence of APL, synovial sheath, and extensor retinaculum strongly correlated with surgical outcomes ($p < 0.0001$), while the intracompartmental septum did not ($p = 0.9625$). USG findings aligned with intraoperative results in most cases but showed some false positives and negatives, highlighting the need for careful clinical interpretation. **Conclusion:** Ultrasonography proves to be a valuable diagnostic tool for De Quervain's Tenosynovitis, with significant correlations between USG findings and intraoperative confirmation, particularly for APL thickening, EPB involvement, synovial sheath abnormalities, and extensor retinaculum changes. However, the presence of an intracompartmental septum was not significantly associated with intraoperative diagnosis or surgical outcomes. While USG aids in preoperative assessment and surgical planning, discrepancies between imaging and intraoperative findings highlight the need for cautious interpretation in clinical decision-making. Further research with larger sample sizes may enhance diagnostic accuracy and surgical prognostication.

INTRODUCTION

De Quervain's tenosynovitis is a painful condition of the tendons on the lateral side of the wrist and is also known as De Quervain's Disease (DQD). The tendons that regulate thumb movement, namely the abductor pollicis longus (APL), extensor pollicis brevis (EPB) are inflamed.^[1] The fibro-osseous sheath that surrounds these tendons is called the wrist's first extensor compartment, and it narrows and becomes inflamed when a person has De Quervain's tenosynovitis. Therefore, the definition of DQD is a stenosing tenosynovitis of the hand's first radiodorsal compartment, which houses the tendons of the APL and EPB. Adults are often affected, with women between the ages of 30 and 50 being the most affected 2 especially if they use repeated hand or wrist motions in their regular activities. On the other hand, it can also occur in men and women of any age who play sports or use hand tools for extended periods of time, activities that put stress on the tendons in the wrist and hand.

First case was reported in 1895 by Fritz De Quervain. According to his theory, workers who performed strenuous activities of wrist (such as assembly workers) were at risk of developing this disease due to repeated strain injuries. This condition usually affects the radial side of the wrist, where it can produce discomfort and tenderness that sometimes spreads up the forearm. A few patients may also have swelling and have difficulty moving their thumbs or gripping items. Engaging in repetitive hand and wrist motions, including pinching, twisting, or gripping, can also make this disease worse. According to the preliminary research, myxoid degeneration rather than an underlying inflammatory condition is thought to be the cause of DQD. Conversely, current research highlights the possibility that inflammatory indicators could predispose to this illness. Recently, other risk factors have been identified, such as exposure to somatotropin and genetic predisposition. Numerous studies have revealed anatomical differences of the first dorsal extensor compartment, and these variations have been demonstrated to impact treatment results.^[2] Physical therapy, corticosteroid injections, and therapeutic ultrasonography are examples of treatment modalities that may need to be customized for the particular wrist anatomy of each patient. Comparing the efficacy of these treatments across large patient cohorts has shed light on the pathophysiology and constantly changing treatment strategy for DQD.^[3] In order to provide light on the current discussion around the genesis, anatomy, diagnosis, and management of De Quervain's tenosynovitis, we have to evaluate the present literature.

With a frequency of 0.94 to 6.3 per 1000 person-years, De Quervain's disease primarily affects women, the elderly, and African Americans. It has shown association with lactating and pregnant women. The intracompartmental septum and

anatomy variations in the tendon and its sheath in the first extensor compartment are the risk factors for this disorder. Though only seen in 20% to 40% of cadavers, the intracompartmental septum is known to occur in 44% to 91% of people with De Quervain's illness. An intracompartmental septum was shown to be more common in patients with De Quervain's illness than in cadavers in two earlier investigations that directly examined the two groups' prevalences. Additionally, a number of studies have indicated that patients with a separated septum may be more susceptible to surgery failure as well as nonoperative therapy failure.^[5]

The objective of this research is to evaluate the diagnostic accuracy of ultrasonography in detecting De Quervain's tenosynovitis, a condition characterized by inflammation of the first dorsal compartment of the wrist. The study aims to compare ultrasonographic findings with intraoperative observations, which serve as the gold standard, to determine the sensitivity, specificity, positive predictive value, and negative predictive value of ultrasonography in diagnosing this condition. By establishing its reliability, the study seeks to assess the utility of ultrasonography as a non-invasive diagnostic tool for De Quervain's tenosynovitis.

MATERIALS AND METHODS

Study design: Hospital based cross sectional study.

Place of study: Department of Radio-diagnosis, Nilratan Sircar Medical College & Hospital, Kolkata.

Period of study: January 2023 to June 2024

Study population: Patients presenting to department of Orthopaedic Surgery, clinically diagnosed to have De Quervain's tenosynovitis and requiring surgical management referred to department of Radiodiagnosis for imaging.

Inclusion Criteria

- Patients with a history of pain in the radial aspect of the wrist, aggravated by excessive use of the thumb were clinically diagnosed by orthopaedic surgeon as a case of dequervain's tenosynovitis by a positive Finkelstein test.

Exclusion Criteria

- Patients with previous history of surgery at the site.
- Patients with rheumatoid arthritis or gout.
- Patients with osteoarthritis of the trapeziometacarpal joint.
- Patients who are unwilling to participate in the study
- Patients who have received steroid injection at the site.

Sample size: 60 Symptomatic patients

Statistical Analysis

The statistical analysis was conducted using Microsoft Excel, SPSS (version 27.0), and GraphPad Prism (version 5). Numerical data were summarized as mean and standard deviation, while categorical data were presented as counts and percentages.

Independent samples were analyzed using two-sample t-tests, whereas paired samples were assessed using paired t-tests for greater statistical power. Chi-square tests, including Pearson's chi-squared test and Fisher's exact test, were used for categorical variable comparisons. Correlation was measured using

Pearson's correlation coefficient. t-tests were performed using standard formulas, with p-values determined from Student's t-distribution. A significance level of $p \leq 0.05$ was considered statistically significant.

RESULTS

Table 1: Association between Side of involvement (right/left wrist): Intraoperative result of De Quervain's Tenosynovitis

Intraoperative result of De Quervain's Tenosynovitis					
Side	Negative(NoDQ)	Positive(DQ)	Total	Chi-square value	p-value
Left	15 (34.9%)	28 (65.1%)	43 (100.0%)	0.7259	0.3942
Right	4 (23.5%)	13 (76.5%)	17 (100.0%)		
Total	19 (31.7%)	41 (68.3%)	60 (100.0%)		

Table 2: Association between all ultrasonography parameter: Intraoperative result of De Quervain's Tenosynovitis

Intraoperative result of De Quervain's Tenosynovitis						
		Negative (No DQ)	Positive (D Q)	Total	Chi- square value	p - value
Abductor pollicis longus thickening ultrasonography	No	5 (83.3%)	1 (16.7%)	6 (100.0%)	8.2242	0.0041
	Yes	14 (25.9%)	40 (74.1%)	54 (100.0%)		
	Total	19 (31.7%)	41 (68.3%)	60 (100.0%)		
Extensor pollicis brevis ultrasonography	No	7 (77.8%)	2 (22.2%)	9 (100.0%)	10.404	0.0012
	Yes	12 (23.5%)	39 (76.5%)	51 (100.0%)		
	Total	19 (31.7%)	41 (68.3%)	60 (100.0%)		
Synovial sheath ultrasonography	No	9 (69.2%)	4 (30.8%)	13 (100.0%)	10.822	0.001
	Yes	10 (21.3%)	37 (78.7%)	47 (100.0%)		
	Total	19 (31.7%)	41 (68.3%)	60 (100.0%)		
Extensor retinaculum ultrasonography	No	9 (90.0%)	1 (10.0%)	10 (100.0%)	18.8703	<0.0001
	Yes	10 (20.0%)	40 (80.0%)	50 (100.0%)		
	Total	19 (31.7%)	41 (68.3%)	60 (100.0%)		
Presence of intracompartmental septum ultrasonography	No	5 (25.0%)	15 (75.0%)	20 (100.0%)	0.6162	0.4324
	Yes	14 (35.0%)	26 (65.0%)	40 (100.0%)		
	Total	19 (31.7%)	41 (68.3%)	60 (100.0%)		

Table 3: Association between all intraoperative parameter: Intraoperative result of De Quervain's Tenosynovitis

		Negative	Positive	Total	Chi- square value	p-value
Abductor pollicis longus intraoperative, Synovial sheath intraoperative & Extensor retinaculum intraoperative	No	19 (100.0%)	0	19 (100.0%)	60	<0.0001
	Yes	0	41 (100.0%)	41 (100.0%)		
	Total	19 (31.7%)	41 (68.3%)	60 (100.0%)		
Presence of intra compartmental septum intraoperative	No	8 (32.0%)	17 (68.0%)	25 (100.0%)	0.0022	0.9625
	Yes	11 (31.4%)	24 (68.6%)	35 (100.0%)		
	Total	19 (31.7%)	41 (68.3%)	60 (100.0%)		

Table 4: Association between all Ultrasonography result with all 5 criteria: Intraoperative result with all 5 criteria

Ultrasonography result with all 5 criteria		Intraoperative result with all 5 criteria		
		Negative	Positive	Total
No	Count	7	2	9
	Expected Count	2.9	6.2	9
Yes	Count	12	39	51
	Expected Count	16.2	34.9	51
Total	Count	19	41	60
	Expected Count	19	41	60

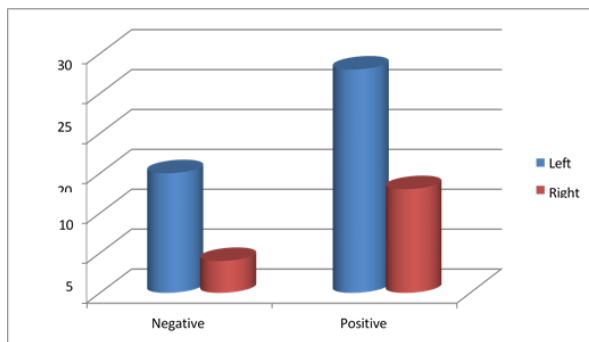


Figure 1: Association between Side of involvement (right/left wrist): Intraoperative result of De Quervain's Tenosynovitis

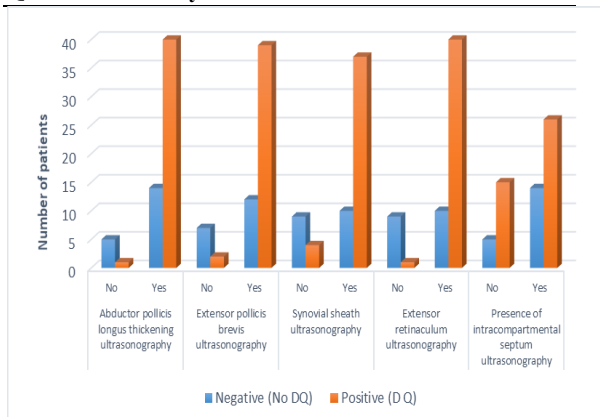


Figure 2: Association between all ultrasonography parameter: Intraoperative result of De Quervain's Tenosynovitis

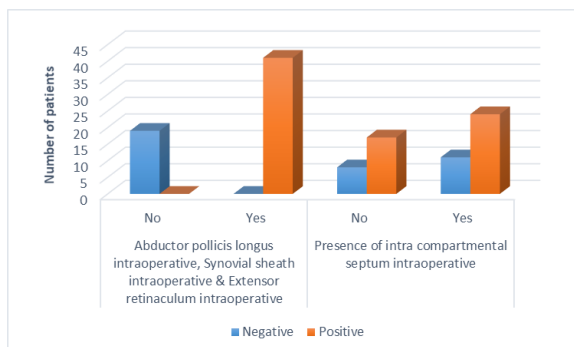


Figure 3: Association between all intraoperative parameter: Intraoperative result of De Quervain's Tenosynovitis

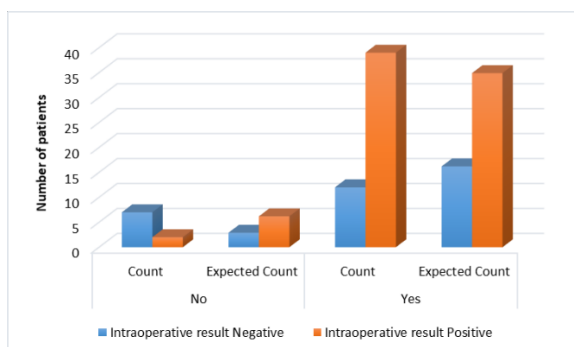


Figure 4: Association between all Ultrasonography result with all 5 criteria: Intraoperative result with all 5 criteria

The intraoperative findings for De Quervain's Tenosynovitis were analyzed based on laterality. Out of 60 cases, 43 (71.7%) involved the left side, while 17 (28.3%) involved the right side. Among left-sided cases, 28 (65.1%) were intraoperatively confirmed as positive for De Quervain's Tenosynovitis, whereas 15 (34.9%) were negative. Similarly, for right-sided cases, 13 (76.5%) were positive, and 4 (23.5%) were negative. The chi-square test yielded a value of 0.7259 with a p-value of 0.3942, indicating no statistically significant association between laterality and intraoperative confirmation of De Quervain's Tenosynovitis.

The intraoperative findings of De Quervain's Tenosynovitis were assessed in correlation with ultrasonographic features, including the thickening of the abductor pollicis longus (APL) tendon, extensor pollicis brevis (EPB) tendon involvement, synovial sheath abnormalities, extensor retinaculum changes, and the presence of an intracompartmental septum. Statistical analysis using the Chi-square test demonstrated significant associations between intraoperative confirmation of De Quervain's Tenosynovitis and ultrasonographic findings in all parameters except for the intracompartmental septum.

Among the patients with APL thickening detected on ultrasonography, 74.1% were confirmed to have De Quervain's Tenosynovitis intraoperatively, while only 16.7% of those without APL thickening had the disease ($p = 0.0041$). Similarly, EPB involvement was significantly correlated with intraoperative diagnosis, with 76.5% of positive cases confirmed surgically ($p = 0.0012$). Synovial sheath abnormalities also showed a strong correlation, as 78.7% of patients with ultrasonographic findings had intraoperative evidence of De Quervain's Tenosynovitis ($p = 0.001$). Extensor retinaculum abnormalities were the most strongly associated, with 80% of patients showing positive intraoperative findings when detected on ultrasonography ($p < 0.0001$). However, the presence of an intracompartmental septum did not show a statistically significant correlation with intraoperative findings ($p = 0.4324$).

These findings suggest that ultrasonographic evaluation of the APL and EPB tendons, synovial sheath, and extensor retinaculum can serve as reliable indicators for the intraoperative confirmation of De Quervain's Tenosynovitis. The lack of significant association with the intracompartmental septum suggests that its presence alone may not be a determinant factor in diagnosing the condition. This study underscores the diagnostic value of ultrasonography in preoperative assessment and surgical planning for patients suspected of having De Quervain's Tenosynovitis.

The chi-square analysis was conducted to evaluate the association between intraoperative findings and outcomes in a sample of 60 patients. Two key variables were analyzed: the presence of the Abductor pollicis longus (APL), synovial sheath, and

extensor retinaculum intraoperatively and the presence of an intra-compartmental septum intraoperatively.

For the first variable, APL, synovial sheath, and extensor retinaculum intraoperative findings, a highly significant association was observed with patient outcomes ($\chi^2 = 60$, $p < 0.0001$). All 19 cases where these structures were absent were negative (100%), while all 41 cases where these structures were present were positive (100%). This strong correlation suggests a direct link between the intraoperative presence of these structures and the surgical outcome. The highly significant p-value indicates that this finding is unlikely to be due to chance.

In contrast, the presence of an intra-compartmental septum intraoperatively did not show a statistically significant association with outcomes ($\chi^2 = 0.0022$, $p = 0.9625$). The distribution of positive and negative cases was nearly identical between the groups with and without an intra-compartmental septum, with no meaningful difference in proportions (No: 32.0% negative, 68.0% positive; Yes: 31.4% negative, 68.6% positive). The high p-value suggests that the presence or absence of an intra-compartmental septum does not significantly impact the surgical outcome.

These findings imply that while certain intraoperative structures, such as the APL, synovial sheath, and extensor retinaculum, are strongly linked to patient outcomes, the presence of an intra-compartmental septum does not play a significant role. This information could be crucial in surgical planning and prognosis estimation. Further studies with larger sample sizes and additional parameters may help validate and refine these observations.

In our study, we analyzed the correlation between ultrasonography (USG) findings and intraoperative results based on five predefined criteria. The data, as presented in Table X, shows that out of 60 cases, 9 were classified as negative by USG, while 51 were positive. When compared with intraoperative findings, 7 of the 9 USG-negative cases were confirmed as negative intraoperatively, whereas 2 turned out to be positive. Among the 51 USG-positive cases, 39 were confirmed as positive intraoperatively, while 12 were false positives. The expected counts for each category were also calculated, revealing variations between observed and expected frequencies. These findings suggest that while ultrasonography is a useful diagnostic tool, discrepancies exist between imaging and intraoperative results, emphasizing the need for careful interpretation in clinical decision-making.

DISCUSSION

The present study was a hospital based cross sectional study. This study was conducted from January 2023 to June 2024 at Department of Radiodiagnosis, Nilratan Sircar Medical College &

Hospital, Kolkata. Total 60 adult patients who were clinically diagnosed cases of De Quervain's Tenosynovitis referred from Orthopaedic surgery outpatient department were included in this study.

In our research study 60 cases were selected as study population with intraoperative findings as gold standard.

The study population consisted of patients in the age group of 33 to 70 years. Maximum number of patients was among 41 to 50 years group which included 46.7% of the total cases. Minimum number of patients were in the age group of 61 to 70 years which included 10% of the total.

It has been found in the present study that maximum intraoperative positive diagnosis for De Quervain's tenosynovitis was among study subjects of 41 to 50 years followed by those of < 40 years. Minimum detection was among people in age group of 61 to 70 years. Association of age group with intraoperative results was not statistically significant. ($p = 0.1400$). Out of 60 study subjects, 41 were positive for De Quervain's Tenosynovitis intra-operatively and had a mean age of (48.8293 ± 9.8714) years as compared to the mean age of (47.6842 ± 6.2544) years in remaining 19 subjects who were negative intraoperatively for De Quervain's Tenosynovitis. However, the association of age group with intraoperative result for DQ was not statistically significant ($p = 0.6450$). In a similar study by Wolf JM et al,^[4] it was noted that age greater than 40 was a significant risk factor for De Quervain's disease, with this age category showing a rate of 2.0 per 1000 person/year compared to 0.6 per 1000 person/year under 20 year. The result of our study was concordant with that of Wolf JM et al.

Among the 60 cases in our study, 55 cases were female patients (91.7%) and 5 cases were male patients (8.3%). It has been found that maximum intraoperative positive cases of De Quervain's tenosynovitis was among female patients. Association of sex of the patient with intraoperative result for DQ was not significant in our study. In a previous literature by Shen PC et al,^[5] (2015) which showed that De Quervain's tenosynovitis is a disease seen primarily in women where female male ratio in the was 7:1. The result of our study is concordant with that of Shen PC et al.

Among the participants of our study 43 (100%) had left wrist involved and 17 (100%) had right wrist involved.

It has been found that 28 (65.1%) were positive intraoperatively for DQ and had left sided wrist involvement and 13 (76.5%) patients were positive intraoperatively for DQ and had right wrist involvement. No patient had both wrists involved. However, this difference in association between the side affected to the intraoperative findings of DQ was not statistically significant ($p = 0.3942$). In a similar study by Shen PC et al,^[5] he found out that left side wrist involvement was more than right side. All patients had a clinical diagnosis of stenosis

tenosynovitis (Left:10; Right:6) and were completely symptom free postoperatively.

54 cases in our study showed Abductor pollicis longus tendon thickening on ultrasonography, out of which; 40 (74.1%) were positive for De Quervain's tenosynovitis intraoperatively.

Association of Abductor pollicis longus on ultrasonography with Intraoperative result for De Quervain's tenosynovitis was statistically significant ($p=0.0041$). 14 (25.9%) patients showed APL thickening on ultrasonography when intraoperatively it was negative. APL thickening on ultrasonography without any intraoperative signs of APL thickening can be due to obliquity and scattering of ultrasonographic beam resulting in anisotropic effect causing tendon to appear hypoechoic. The normal muscle fibres tapering at musculotendinous junction can be misinterpreted as thickened tendon sheaths.

51 cases in our study showed Extensor pollicis brevis tendon thickening on ultrasonography of which 39 (76.5%) patients were positive for De Quervain's tenosynovitis intraoperatively as opposed to 12 (23.5%) patients where EPB thickening was seen on ultrasonography but no tendon thickening intraoperatively. Association of Extensor pollicis brevis ultrasonography with Intraoperative result of De Quervain's Tenosynovitis was statistically significant ($p=0.0012$).

Of the 47 cases which showed synovial sheath thickening in ultrasonography 37 (78.7%) patients were positive for De Quervain's tenosynovitis intraoperatively as opposed to 10 (21.3%) whose synovial sheath thickening was seen on ultrasonography but was negative for De Quervain's tenosynovitis intraoperatively. Association of synovial sheath on ultrasonography with intraoperative results for De Quervain's Tenosynovitis was statistically significant ($p=0.0010$). Of the 40 cases that showed presence of intracompartmental septum in the first dorsal compartment on ultrasonography 26 (65%) patients were positive and showed intracompartmental septum intraoperatively. Association of intracompartmental septum on ultrasonography with intraoperative result of De Quervain's tenosynovitis was not statistically significant ($p=0.4324$).

In a similar study conducted by Morisaki S et al (2023),^[6] they measured the diameter of the tendons of the abductor pollicis longus (APL) and extensor pollicis brevis (EPB), and the thickness of the synovial sheath and the intercompartmental septum if present and compared it to the asymptomatic side. Affected side showed significant thickening of APL and EPB than on the asymptomatic side (APL: 13 mm² versus 8.3 mm²; $P < .0001$; EPB: 5.4 mm² versus 3.9 mm²; $P = .031$). The synovial sheath was significantly thicker on the affected side (1.5 mm) than on the asymptomatic side (0.95 mm) ($P < .0001$). The intercompartmental septum was significantly thicker on the affected side (1.1 mm) than on the asymptomatic side (0.72 mm) ($P = .0004$). Operative findings revealed (80%) patients had an

intercompartmental septum. In our study P values for APL thickening on ultrasonography was statistically significant ($p=0.0041$) and is similar to the p value in the above mentioned study. The P value for EPB thickening in our study was statistically significant ($p=0.0012$) but in the above study p value was not significant. In our study the P value for synovial sheath thickening on ultrasonography was statistically significant ($p=0.0010$) and similar to p value in the above mentioned study.

In our study, Extensor Retinaculum thickening on ultrasonography is found in 40 (80%) patients, who also showed positive result intraoperatively as opposed to 10 (20%) patients which showed thickening on ultrasonography but intraoperatively no thickening (negative for De Quervain's tenosynovitis). Association of Extensor retinaculum on ultrasonography with intraoperative result of De Quervain's Tenosynovitis was statistically significant ($p<0.0001$).

In our study the mean thickness of extensor retinaculum seen in ultrasonography in clinically diagnosed cases of De Quervain's disease was 1.2mm which is similar to the studies by Lee KH et al and Das A et al.

Lee KH et al,^[7] (2014) The mean thickness of the extensor retinaculum was 0.94 mm (SD 0.37) in the case group and 0.35 mm (SD 0.07) in the control group, and this difference was significant. The cutoff value of the extensor retinaculum for diagnosing De Quervain's disease was 0.45 mm (sensitivity 96.3%, specificity 93.3%). In another study Das A et al (2017),^[8] found thickened extensor retinaculum in over the first dorsal compartment of the wrist in 15 clinically diagnosed cases of De Quervain's disease. Mean thickness of the retinaculum was 1.6mm.

The Pearson Correlation Coefficient (r) was .416, as we discovered, the results of which were statistically significant [$.001$]. It showed a positive connection between the ultrasonographic result with all five criteria for DQ and the intraoperative result with all five criteria for DQ.

Our research compared the intraoperative result with all five criteria to the ultrasonographic result with all five criteria. 95.1 is the sensitivity, 36.8 is the specificity, 76.5 is the positive predictive value, 77.8 is the negative predictive value, and 76.67% is the accuracy.

Association of Ultrasonographic result with all 5 criteria with Intraoperative result with all 5 criteria was statistically significant ($p=0.0012$).

According to our research, the difference between the intraoperative and ultrasonographic results for all five criteria had a kappa value of [.372], which was statistically significant ($p=0.001$).

CONCLUSION

We concluded that compared to intraoperative findings, which are considered the gold standard, ultrasonography is a highly accurate diagnostic tool

for identifying De Quervain's tenosynovitis, with great sensitivity and specificity. The results support the use of ultrasonography as a first-line, non-invasive diagnostic technique by suggesting that it can accurately detect cases of De Quervain's tenosynovitis. This method has the potential to reduce the requirement for invasive treatments, which not only correlates well with intraoperative data but also delivers major clinical benefits. As a result, the study suggests that ultrasonography be used in routine clinical practice to evaluate patients who may have De Quervain's tenosynovitis.

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