



## The importancy of finger extension test in the diagnosis of occult wrist ganglion

### *Okült gangliyon tanısında parmak ekstansiyon testinin önemi*

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**Amaç:** Dorsal el bileği ağrısı nedenlerinden biri olan okült dorsal el bileği gangliyonunda tanı araçlarının kesinlik değeri cerrahi tedavi sonuçlarıyla karşılaştırmalı olarak incelendi.

**Çalışma planı:** Çalışmaya okült gangliyon öntanısıyla cerrahi tedavi uygulanan 25 hasta (4 erkek, 21 kadın; ort. yaş 29; dağılım 16-46) alındı. Yakınma süresi ortalama 29 ay (dağılım 3 ay-10 yıl) olan hastalarda daha önce konservatif tedavi denenmişti. Tanı için 24 hastada parmak ekstansiyon testi kullanıldı. Altı hastada ultrasonografik incelemeye, 13 hastada manyetik rezonans görüntülemeye (MRG) başvuruldu. Cerrahi sırasında üç hastada posterior interosseöz sinir nörektomisi uygulandı. Ortalama izlem süresi 31 aydı (dağılım 6-72 ay).

**Sonuçlar:** Yirmi beş hastanın 22'sinde (%88) okült dorsal gangliyon skafolunat bileşkededen çıkarıldı. Üç hastada gangliyon kitlesine rastlanmadı. Bu hastalarda skafolunat bağda dejenerasyon gözlemlendi. Parmak ekstansiyon testi 24 hastanın 23'ünde pozitif bulundu. Testin negatif olduğu hastada, cerrahi sırasında skafolunat bağda dejenerasyon gözlemlendi. Parmak ekstansiyon testi iki hastada yanlış pozitif sonuç verdi. Bu hastaların birinde MRG negatifti. Manyetik rezonans görüntüleme yapılan 13 hastanın 11'inde, ultrasonografi yapılan altı hastadan dördünde cerrahi olarak sonuç doğrulandı. Buna göre MRG'nin tanı koyduruculuğu %92, ultrasonografinin %66, parmak ekstansiyon testinin %92 bulundu. Cerrahi sonrasında nüks gözlenen iki hastada (%8) ikincil ameliyat gerekti. Geç dönem instabilite bulgusu ile karşılaşılmadı. Biri dışında tüm hastalar (%96) semptomsuz hale geldi.

**Çıkarımlar:** Parmak ekstansiyon testi, okült gangliyon tanısında %92'lik tanı değeriyle önemli bir testtir. Okült gangliyon tanı ve tedavisi gelişen tanı yöntemleri nedeniyle kolaylaşmıştır.

**Anahtar sözcükler:** Gangliyon kisti/cerrahi; manyetik rezonans görüntüleme; ultrasonografi; el bileği.

**Objectives:** The aim of this study was to evaluate the accuracy of diagnostic tools in comparison with surgical results of occult ganglion cyst of the wrist, which is one of the causes of chronic wrist pain.

**Methods:** Twenty-five patients (4 males, 21 females; mean age 29 years; range 16 to 46 years) underwent surgery with an initial diagnosis of occult ganglion following unsuccessful conservative treatment. The mean symptom duration was 29 months (range 3 months to 10 years). Diagnosis was based on finger extension test performed in 24 patients. Six patients and 13 patients were assessed by ultrasonography and magnetic resonance imaging (MRI), respectively. Interosseous neurectomy was performed in three patients. The mean follow-up was 31 months (range 6 to 72 months).

**Results:** Occult dorsal ganglion was resected from the scapholunate interval in 22 patients (88%). No ganglion was found in three patients, who had only degeneration of the scapholunate ligament. Finger extension test was positive in 23 patients. One patient with a negative test result was found to have degeneration of the scapholunate ligament. The test yielded two false positive results, one of which was negative by MRI. Surgical confirmation was achieved in 11 patients evaluated by MRI and in four patients evaluated by ultrasonography. Diagnostic accuracy rates for MRI, ultrasonography, and finger extension test were 92%, 66%, and 92%, respectively. Two patients (8%) underwent reoperation for recurrence. None of the patients complained of instability in the late period. Except for one patient, all patients (96%) were asymptomatic at final evaluations.

**Conclusion:** Finger extension test is an important diagnostic tool for occult ganglion with 92% accuracy. Both diagnosis and treatment of occult ganglion cysts have become easier by evolving diagnostic tools.

**Key words:** Ganglion cysts/surgery; magnetic resonance imaging; ultrasonography; wrist.

Occult dorsal wrist ganglion benign cystic mass which is generally located in the dorsal scapholunate interval and do not have an observable symptom except for the point tenderness on the wrist through the routine examination. It is considered as synovial hernia as a result of the degenerative change of ligamentous tissue.<sup>[1,2]</sup> Occult dorsal wrist ganglion (ODWG) is only one of the chronic wrist pain. Diagnostic approach in chronic wrist pain has varied in time. Studies stating the different pathologies such as the fourth compartment syndrome, posterior interosseous nerve compression or occult ganglion were published.<sup>[3-7]</sup> However, mostly it is difficult to find out the real source of the pain.

Moreover the diagnosis includes a wide spectrum. Different pathologies such as posterior interosseous neuropathy, avascular necrosis of carpal bones, carpal instabilities, tumours, inflammatory arthropathies and extensor tenosynovitis are taken into consideration in diagnosis.<sup>[5,8,9]</sup> X-ray, magnetic resonance imaging and ultrasonography are used in order to verify the clinic diagnosis.<sup>[10-15]</sup>

Special diagnosis pursuit having started with the surgical exploration added occult ganglion studies in the literature by the help of the development in diagnosis equipment as of 1980s. Generally, it is observed that the publications related to ODWG consist of a small number of patients.<sup>[6,9,13]</sup> The highest number for the studies was given by Lluch and Garcia Elias with 65 cases.

Scaphoid shift test<sup>[17]</sup> and finger extension test<sup>[18]</sup> are the ones that can be used for ODWG diagnosis during the physical examination. Scaphoid shift test is helpful in distinguishing instability. However, no publication on the use of finger extension test for ODWG diagnosis has appeared in the literature.

The fact that the occult dorsal wrist ganglion is not visible and hard to detect with the diagnostic methods cause that generally it cannot be diagnosed for a long time or the patients waste their time with the conservative treatment or are treated inefficiently. Mostly it is difficult to go towards ODWG among the diagnoses stated above. Finger extension test can be implemented in order to overcome this difficulty concerning diagnosis.

The aim of this study is to research the clinical importance of the finger extension test and point out

its relation to the auxiliary methods for diagnosis and surgical results.

## Patients and the method

25 patients who have been diagnosed with occult ganglion (4 males, 21 females, the mean age is 29; range 16 to 46) have been put into the study. There was trauma in the story of three patients. The complaint period was 29 months in average (range 3 months to 10 years). It was found out that conservative treatments had already been tried on sixteen patients in other centres before the surgical treatment and three of them had been injected cortisone.

In the physical examination, dorsal wrist pain and the discomfort while moving enable that ODWG is suspected. All the patients had pain on the scapholunate area in wrist dorsal. However, no palpable mass was detected. No decrease in the movements was observed. Finger extension was used for diagnosis (Picture 1). In this test while the wrist was being kept in the palmar flexion, the pain was felt in the wrist dorsal during the extension of the third finger against the resistance. Scaphoid shift test was taken into consideration during the physical examination in terms of carpal instabilities.

Instability series wrist radiographs were taken for the radiographic examination (PA / lateral / radial / ulnar deviation). Radiography was helpful in order to identify the degenerative changes in static carpal instabilities, Kienböck disease and radiocarpal artic-



**Figure 1.** Implementation of finger extension test: The patient is asked to keep fingers in extension by putting his wrist in the flexion. In the meantime finger extension is blocked through the resistance implemented from dorsal. If there is a pain in dorsal 3-4<sup>th</sup> compartment it means that the test is positive.

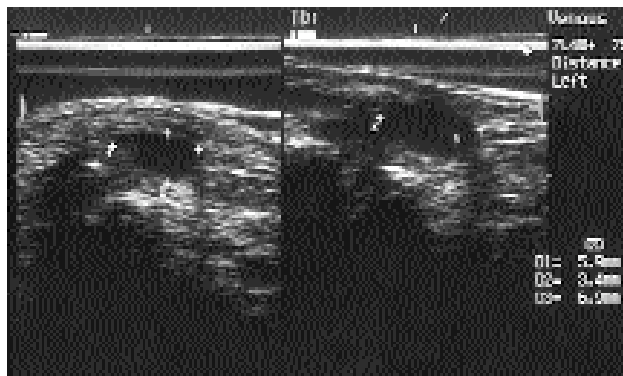
ulation. Ultrasound analysis was carried out by an experienced radiologist by using 9 MHz changeable probes (Sonoline, Siemens, Erlangen, Germany). While the wrist was in the neutral position axial and sagittal images were taken. Magnetic resonance cross sections were taken in every three millimeters (0.3 Tesla, Magnetom Concerto, Siemens). Axial and sagittal T<sub>1</sub> and T<sub>2</sub>- weighted images were analysed.

Ultrasonographic analysis was carried out on six patients due to the fact that MRI was not widely used in the first cases (picture 2). After MRI had become widespread as a good tool of diagnosis for soft tissue MRI was used on 13 patients (Picture 3a,b)

Conservative treatment was performed for all the patients before the surgical treatment. Anti inflammatory drugs, local steroid injections and palmar wrist splint were used at least for six months. One or more diagnostic tools among finger extension test, USG and MRI was used and it was decided to carry out an operation for the patients who did not react to the conservative treatment.

Finger extension test was used with MRI for 13 patients and with USG for five patients. Diagnostic tools were used individually or together for the other patients. Finger extension test was performed in all the patients except one.

Dorsal transverse incision marginal excision was performed in 25 patients for whom surgical treatment after diagnosis was decided. During the operation the basic principles, which have been published in the previous studies were followed. Lesion was traced to the origin and tried to be resected totally. Degeneration and whether the scapholunate liga-

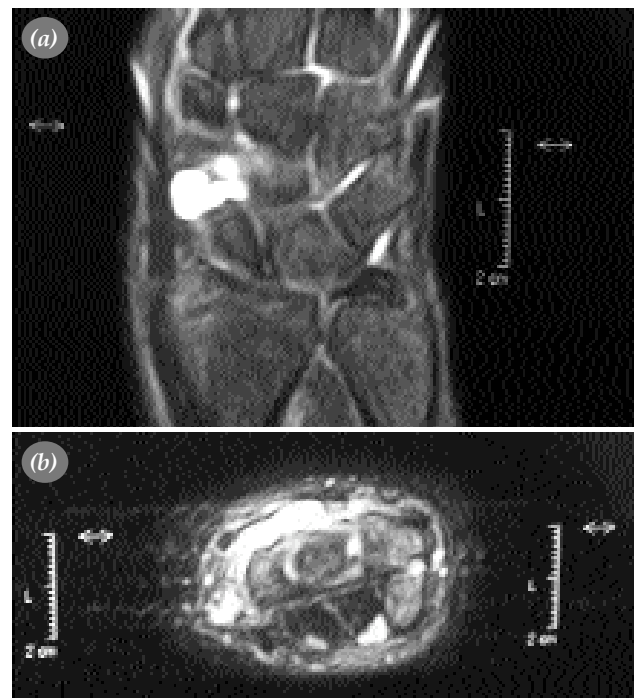


**Figure 2.** The image of 4-5 mm occult ganglion in ultrasonography.

ment rupture was observed (Picture 3b). Posterior interosseous neurectomy was applied on three patients. Compressive bandage was applied on the patients after the operation. They were asked to start active finger and wrist movements immediately. It was paid attention that total active movement of the wrist did not exceed 40-50° in order to allow maturation of scar tissues on dorsal within the first six weeks. Wrist splint wasn't applied. Daily life activities were allowed and the occupational activities started by the 8<sup>th</sup> week. The average follow up period was 31 months (range 6-72 months).

## Results

Finger extension test was performed in 24 patients and it was positive in 23 patients. Degeneration on scapholunate ligament was observed during the operation in the patient whose test was negative. No ganglion was found in this patient. When finger extension test was compared with the surgical results, false positive results were reached for two patients. MRI in one of the patients was negative. During the operation, occult ganglion was not found in the patients whose finger extension tests were false positive. There was degeneration



**Figure 3.** (a, b) In the magnetic resonance imaging of occult ganglion, under extensor tendons and not hernia under the skin.

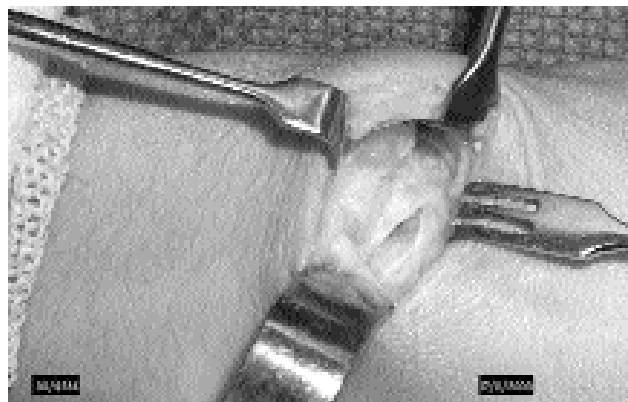
only on scapholunate ligament. The result was a painless wrist. Thus, the predictive value of finger extension test during the physical examination was determined as 92%.

No static carpal instability symptom was observed in the scaphoid shift tests and radiographic analysis of the patients. Diagnosis was confirmed in four of six patients who had been subject to ultrasonography. There was false negative result for two patients and diagnostic accuracy rate was determined as 66%. Finger extension test was positive for these two patients and the ganglion mass was confirmed by an operation.

The diagnosis was surgically confirmed in 11 out of 13 patients who were subject to magnetic resonance imaging. Finger extension test was positive for these eleven patients. In the operation occult ganglion was resected from one of the patients whose magnetic resonance imaging was negative. Degeneration on scapholunate ligament was observed in the other patient. In accordance with this case, MRI yielded false negative result in one patient. There were some changes that were considered as interstitial oedema on a small area of scapholunate joint in MRI of the patient who had scapholunate ligament degeneration. However, negative result was obtained by MRI for this patient. Consequently, diagnostic accuracy rate of MRI was determined as 92%.

#### Findings during the operation

Occult dorsal ganglion was resected from scapholunate interval in 22 out of 25 patients (88%) (Picture 4). Ganglion was not found in three patients. Degeneration on scapholunate ligament



**Figure 4.** Surgical resection of occult ganglion mass under the tendons distal to extensor retinaculum

was observed in these three patients. The decision for operation was taken in accordance with the clinical findings in one patient and positive result of finger extension test for two patients. These patients did not have long-term complaints.

Before the operation, the pain was felt particularly because of carrying heavy things in all the cases. After excision moderate-level pain (4%) was detected in one patient. No symptoms were left in 24 patients (96%). Two patients (8%), underwent reoperation for recurrence. There were no range of motion limitations for the patients after the operation and no problem arose in the other monitoring activities.

Ganglion was surgically found in two patients who had posterior interosseous neurectomy and the other patient did not have ganglion. Three patients in this group did not have any complaint in the last controls

#### Discussion

In the orthopaedic literature, it can be realized that the publications related to ODWG focus on two main topics; methods of diagnosis and ganglion surgery. ODWG diagnosis requires more research in accordance with the ganglion that can be diagnosed by inspection. In 1980s, painful wrist studies having been explored only by clinical pre-diagnosis was privatized with the development of diagnostic tools and replaced by the other studies that can be diagnosed as occult ganglion.<sup>[6,11,14,16]</sup> ODWG diagnosis is reached by an algorithm basing on exclusion of the diseases having similar symptoms. The fact that there are no tests to be used by the clinician makes the diagnosis clear. Only Sanders<sup>[2]</sup> used temporary relief through xylocain injection on the dorsal capsular area. In our study finger extension test helped diagnosis by 92%. It is easy to be performed in the physical examination so its usage is suitable. During the implementation of the test, observing ache in 3-4<sup>th</sup> compartment dorsal makes ODWG be considered. Before the operation scaphoid shift test has to be performed and scapholunate instability has to be searched in these patients.<sup>[17,19]</sup> However, it was pointed out that this test may be positive in the normal people as the patients having ganglion. Hwang et al.<sup>[19]</sup> observed that the test yielded negative result in 89% of the patients after the operation. Hayashi et al

<sup>[3]</sup> stated that occult ganglion on dorsal wrist, muscle variations or tenosynovitis could trigger the ache with posterior interosseous nerve compression. Positive result of finger extension test in our study is in parallel with the ideas of Hayashi et al.<sup>[13]</sup>

There are no clear data about the superiority of MRI and USG, the auxiliary diagnostic tools. The number of the cases in the study is low.<sup>[10,15]</sup> Magnetic resonance imaging has a few disadvantages because of the cost and long period of imaging. As in the literature, specificity of diagnostic tools were determined high in our studies. Magnetic resonance imaging is accurate by 92 % and USG is 66 %. Occult ganglion may not be detected by auxiliary diagnostic tools or false negative diagnosis can be yielded. In this case, as in our study, use of finger extension test as a new diagnostic tool overcomes the difficulty in diagnosis. Vo et al.<sup>[14]</sup> performed MRG in 10 patients with occult ganglion diagnosis and obtained a false negative result from only one patient when they had compared it with the surgical results. In this study the average size of ganglion is 4.7 mm. Cardinal et al.<sup>[15]</sup> compared USG and MRI for ODWG and found that false positive results and false negative results were very close to each other due to the small number of disease studies, which was 14. Osterwalder et al.<sup>[11]</sup> stated that as a result of an USG examination the specificity was 88 % and sensitivity was 85 % for ODWG in the 168 patients having wrist pain, but they added that it could be confused with hematoma, repair tissue, neurogenic repair tissue, tendon regeneration and cavernous hemangiomas. This difficulty in diagnosis can be overcome by the use of higher frequency probes (>10 MHz).<sup>[12]</sup> In the study of Ogino et al.<sup>[13]</sup> USG's accuracy was determined as 100 %. In our study the ultrasonographic results are not clear due to the fact that they were not used much. However, diagnostic accuracy rate will be clear through the increase in the number of the cases and with the comparative studies. Also it will be useful if ultrasonography is performed by an experienced radiologist.

When we review the surgical studies on occult dorsal wrist ganglion we see that the study of Lluch and Garcia-Elias<sup>[16]</sup> has the maximum cases. It is followed by Sanders,<sup>[2]</sup> Gunther,<sup>[7]</sup> Steinberg and Kleinman,<sup>[6]</sup> respectively. There were no diagnostic methods in the initial studies (USG, MRG, finger

extension test), so after X-ray operation was decided and scapholunate ligament exploration and/or partial excision used to be performed. In accordance with Lluch and Garcia-Elias,<sup>[16]</sup> ODEG is caused by the partial scapholunate ligament rupture. It is suggested to resect dorsal distal tendons of ligament. Sanders<sup>[2]</sup> performed operations on the patients who did not have palpable mass and instability symptom, whose X-ray result were normal and scaphoid shift test is negative, and the diagnosis was histologically confirmed in 18 patients (85%). Ganglion cyst on scapholunate ligament and mixomatous degeneration was observed. The study of Gunther<sup>[7]</sup> consisted of 10 cases. He performed scapholunate ligament excision. Steinberg<sup>[6]</sup> excised the tissue between dorsal scaphotriquetral ligament and radiotriquetral ligament. In the study of Clay and Clement<sup>[11]</sup> ganglion is originated from scapholunate ligament in 76% of the cases. It was determined that the chronic stresses on ligament could cause it. In our study it was observed that ganglion was originated from scapholunate by 88 %. No additional scapholunate ligament excision was performed. The main problem is that ganglion in small size can be damaged or overlooked. We think that capsular excision ensures curative effect in three patients who do not have ganglion. Depending on the low rate of recurrence and that no instability is developed at the end of a long follow up period, we can conclude that ligament excision is not very necessary.

The authors are also indecisive about the posterior interosseous nerve that is one of the anatomic structure herein and may be a reason of pain. Sanders<sup>[2]</sup> identified that the most possible pathology mimicking ODWG was an isolated scapholunate ligament rupture. Steinberg thought that posterior interosseous nerve was unnecessary and performed a dorsal tangential excision from scapholunate ligament. Moreover, some authors have pointed out some definitions such as "distal posterior interosseous nerve syndrome", "the fourth compartment syndrome". That is why denervation operations for pain treatment and posterior interosseous neurectomies are carried out.<sup>[3,4]</sup> However, in the anatomic studies on wrist denervation, the diameter of posterior interosseous nerve was 0.87 mm.<sup>[20]</sup> In accordance with Gunther<sup>[7]</sup> it is impossible for such a millimetric occult ganglion to create compression on nerve. He argued that the pain was caused by scapholunate lig-

ament pathology and resected some part of it. In our studies it was understood that these kinds of indications were completely based on the choice of the surgeon. We are of the opinion that the capsular excision performed here includes posterior interosseous nerve ends and ensure sufficient denervation. In order to increase the surgical effectiveness for the patients who have severe pain for a long period posterior interosseous neurectomy can be considered.

The disadvantage of our study is that ultrasonographic and magnetic resonance imaging cannot be compared with finger extension test in all the patients. In the literature, it is observed that the number of the comparative publications on difficulties in diagnosis is very low. Histologically confirmed comparative studies are required. When the clinic and surgical experience increase, it is likely that the publications will increase. Watson identified pre-dynamic instability on wrist and detected synovitis findings without any rupture on scapholunate ligament. During the surgical exploration, ODWG observed in some of the patients who have the disease called as "dorsal wrist syndrome".<sup>[17]</sup> Predynamic instability and ODWG may be transition diagnosis. When the ligament degeneration increases on the wrist, the case symptomatically course on a line extending to ganglion that can be observed on the wrist. Because ganglions have been considered to be caused by ligament degeneration since Angelides (1976).<sup>[19]</sup>

Consequently, occult dorsal wrist ganglion is a wrist pathology that can be confirmed by the auxiliary diagnostic tools for clinical diagnosis. In particular, it should be taken into consideration for the distinguishing diagnosis of chronic wrist pain. In our study finger extension test is identified as a good method of physical examination with 92 % accuracy

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