

CLINICAL VALIDITY OF THE ELBOW FLEXION TEST FOR THE DIAGNOSIS OF ULNAR NERVE COMPRESSION AT THE CUBITAL TUNNEL

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We evaluated the elbow flexion test in 216 elbows without compression of the ulnar nerve at the cubital tunnel and without other neuropathies. We used Rayan's four positions as our test. The percentage of positive tests was only 3.6% at one minute, whereas evaluating the responses at three minutes we saw positive results in 16.2%. Therefore we find that if the test is performed for one minute it may be useful to help in diagnosing ulnar nerve compression at the cubital tunnel.

Keywords : ulnar nerve ; elbow ; elbow flexion test.

Mots-clés : nerf cubital ; coude ; test de flexion du coude.

INTRODUCTION

The elbow flexion test has been proposed for clinical evaluation of ulnar nerve compression at the cubital tunnel. This test is analogous to Phalen's test which is used to evaluate median nerve compression at the carpal tunnel. The diameter of the cubital tunnel narrows by 55% when the elbow is flexed and the nerve thins and stretches 5 mm for every 45° of elbow flexion (1).

It can be inferred that prolonged elbow flexion may cause either the onset or worsening of paresthesias or pain in the ulnar nerve innervation area owing to compression of the arcuate ligament (also called epitrochleo-olecraneal ligament) on the nerve.

In the literature there is some controversy as to the clinical validity of the elbow flexion test. Buehler and Thayer, for instance, consider this test

as a diagnostic one (2), on the other hand Rayan et al. see it as unreliable in view of the number of false positive results (8). The aim of our study was to evaluate the soundness of this test on a significant number of healthy subjects.

MATERIAL AND METHODS

We examined 216 elbows in 108 subjects. Sixty-six of them were males and 42 were females ranging from 19 to 74 years old with a mean age of 46.8 years. All subjects were volunteers ; some of them worked in our department and others were either patients seen in the emergency room or hospitalized for various pathologies.

Subjects with ulnar nerve compression at the cubital tunnel, ulnar nerve dislocation at the cubital tunnel, cervicobrachialgias, other neuropathies than at the cubital tunnel, sequelae of elbow fractures, axial deviations of the elbow or diabetes mellitus were excluded from our study.

Ninety-four of the volunteers (87%) were right-handed, 11 (10.2%) were left-handed, 3 (2.7%) were ambidextrous ; 10 (9.2%) were heavy laborers.

We used Rayan's four positions (fig.1) (8) in our tests : all subjects were sitting with both elbows flexed at 90° and had : 1) the shoulder and wrist in neutral position (T1 position) ; 2) the shoulder in neutral position and wrist in full extension (T2 position) ; 3) the shoulder in abduction to 90° and wrist in neutral position (T3 position) ; 4) the shoulder in abduction

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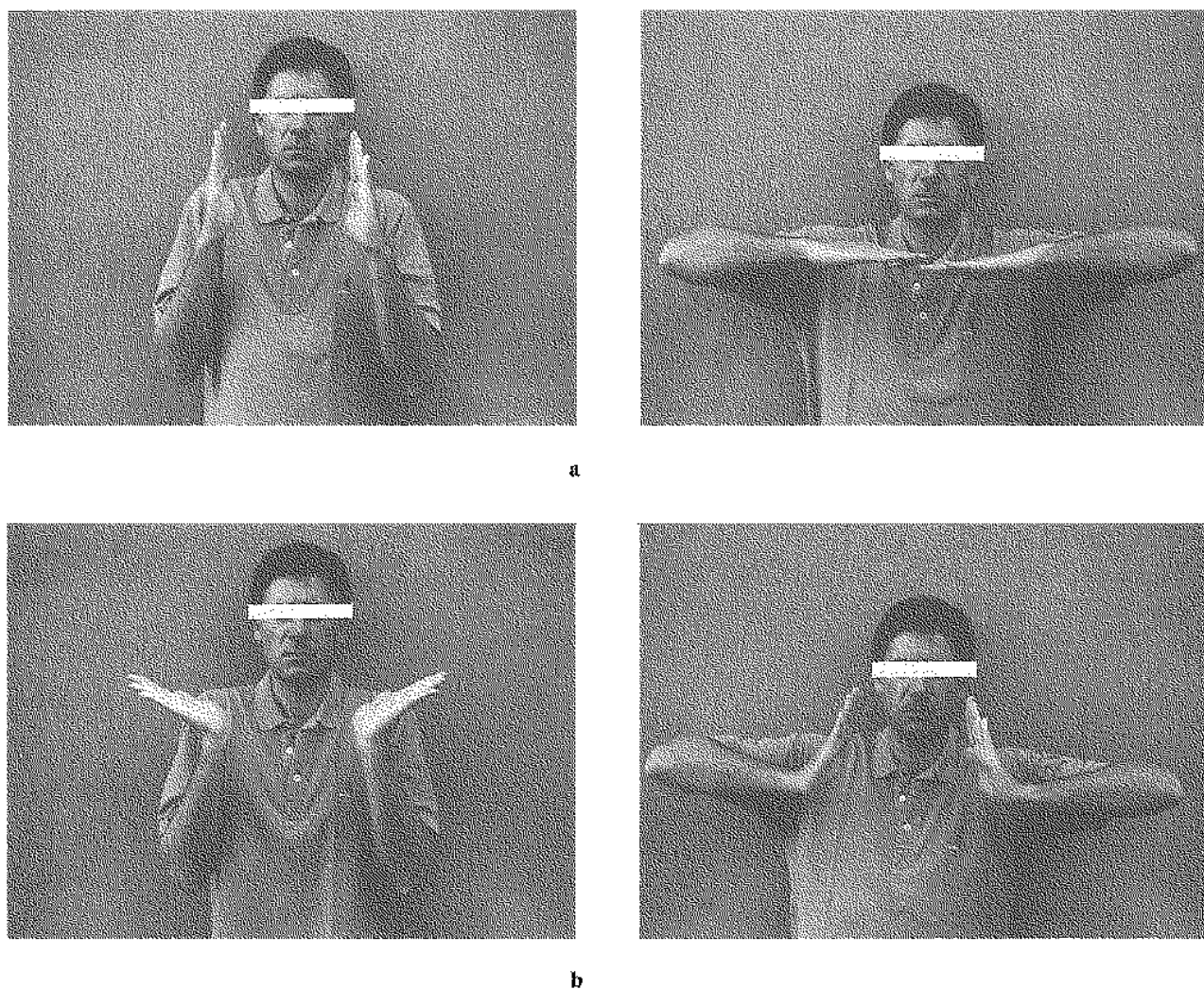


Fig. 1. — a) Rayan's first position (T1) ; b) Rayan's second position (T2) ; c) Rayan's third position (T3) ; d) Rayan's fourth position (T4).

Table 1. — Elbow flexion tests and gradation of the responses

	elbow	shoulder	wrist	30°	60°	120°	180°
T1	90° flexion	neutral	neutral				
T2	90° flexion	neutral	full extension				
T3	90° flexion	90° abduction	neutral				
T4	90° flexion	90° abduction	full extension				

grade 0 = no paresthesias, no pain

grade 1 = mild paresthesias and/or pain in the ulnar innervated areas

grade 2 = moderate paresthesias and/or pain in the ulnar innervated areas

grade 3 = severe paresthesias and/or pain in the ulnar innervated areas

to 90° and wrist in full extension. We recorded every occurrence or increase of paresthesias in the ulnar nerve area that the subjects reported in each position at 30, 60, 90 and 180 seconds (see table I).

RESULTS

All the volunteers completed the entire test with the exception of a woman who interrupted it at 2 minutes and 45 seconds because of acute scapulohumeral pain due to peri-arthritis.

Sixty-six elbows (30.5%) had a positive test response, seven of which (3.6%) were positive after one minute, 24 (11.1%) after two minutes and 35 (16.2%) after three minutes. Obviously, the ones who were positive after 1 or 2 minutes were also positive later.

In 65 cases the severity of symptoms was grade 1 (mild paresthesias and/or pain in the ulnar nerve area) and in 1 case grade 2 (moderate paresthesias and/or pain in the ulnar nerve area). Symptoms were bilateral in 10 subjects (9.2%).

2 or 3 minutes is greater when abduction of the shoulder is involved (T3, T4).

The test with the shoulder in neutral position, the elbow flexed and the wrist in full extension (T2) was positive in only 3 cases and after 3 minutes, thus suggesting that extension of the wrist does not produce relevant stretching of the ulnar nerve at the elbow.

Positive results usually increase with the passing of time, even in the case of a combination of tests, as we note if we consider the positiveness to one test only (T1, T2, T3, T4), positiveness to a combination of two tests (T1 + T2, T1 + T4, T2 + T4) or of three tests (T1 + T2 + T3, T1 + T2 + T4, T1 + T3 + T4, T2 + T3 + T4) with the only exceptions being the combinations T3 + T4 and T1 + T2 + T3 + T4, where positiveness was greater after 2 minutes than after 3 minutes.

The age of the volunteers we examined was not found as relevant as other authors (8) state; indeed 28 out of the 66 subjects who had positive test responses (42% of the positive cases) were older than 45 years (12.9 % of all subjects); similarly, the occupation of the subjects was irrelevant (only 2 out of the 10 volunteers who were heavy laborers were positive to one of the tests).

Table II. — Positive responses to elbow flexion test

Test	30"	60"	120"	180"
T1	—	—	1	3
T2	—	—	—	3
T3	—	2	3	5
T4	—	—	1	6
T1 + T2	—	—	2	1
T1 + T4	—	—	—	1
T2 + T4	—	—	—	1
T3 + T4	—	—	5	3
T1 + T2 + T3	—	2	1	—
T1 + T2 + T4	—	—	—	2
T1 + T3 + T4	—	—	1	—
T2 + T3 + T4	—	3	2	6
T1 + T2 + T3 + T4	—	—	8	4

Table II shows the results of positive elbow flexion tests.

It is noteworthy that after one minute only a few types or combinations of tests were positive, particularly when abduction of the shoulder is required (T3, T4) since in this position nerve tension increases owing to nerve tightening (6). Analogously, the incidence of positive results after

DISCUSSION

The cubital tunnel is an osteofibrous tunnel bordered medially by the epitrochlea and laterally by the olecranon; its floor is formed by the elbow capsule and the posterior part of the ulnar collateral ligament, while its roof is made up of the epitrochleo-olecranal ligament and by a fibrous band that bridges the two ends of the flexor carpi ulnaris (7).

Under normal conditions the maximum tunnel capacity is reached when the elbow is extended; when the elbow is flexed it narrows and the ulnar nerve is compressed by the arcuate ligament (1,7). It is tightened behind the epitrochlea.

When the elbow is flexed to 90°, pressure inside the cubital tunnel increases by 5 mm Hg and it rises as flexion increases; incision of the arcuate ligament reduces pressure by 50%. It must be considered that elbow flexion entails an extraneu-

ral pressure over 200 mm Hg: prolonged compression causes either ischemic fibrosis or thinning of the myelin sheath (6).

Electrophysiologically 45° flexion of the elbow provokes an increase in motor and sensory ulnar nerve conduction velocities (4).

Patients suffering from cubital tunnel syndrome have been treated with night splints; the elbow should be flexed between 45° and 70° and the wrist supported in order to relax the flexor carpi ulnaris. After treatment symptomatology improved in 86.3% of patients (3) and in 94% of the cases when the onset of disease was less than 3 months (9).

The three suggested surgical treatments (anterior transposition of the ulnar nerve, neurolysis, medial epicondylectomy) aim to free the nerve from extrinsic compression and to decrease nerve tension when the elbow is flexed: intraoperatively, after neurolysis, the possibility of medial epicondylectomy is evaluated in the presence of nerve traction or angulation behind the epitrochlea (5).

From what we have said we can easily infer that elbow flexion may initiate or worsen symptomatology in the case of ulnar nerve compression at the cubital tunnel. We evaluated a number of healthy subjects comparable to the group of volunteers examined by Rayan who denied the clinical value of this test. Contrary to what this author stated we did not believe the test was useless since elbow flexion is considered as an etiopathogenetic factor of the cubital tunnel syndrome. Moreover, we had previously noted that patients with ulnar nerve compression at the cubital tunnel were positive on the elbow flexion test, even if we did not perform it systematically on all patients suffering from this pathology (5).

The results of our test indicate that it is invalid if performed for 3 minutes; indeed 16.2% of our healthy subjects were positive to the test after 3 minutes while after 1 minute the percentage was only 3.6%. Probably the number of positive responses would increase if the test lasted longer. We think that a time limit for the test should be fixed, which we suggest as 1 minute.

Our seven positive responses after one minute may be false positive cases or, more probably, may represent clinical or anatomical conditions where

ulnar nerve compression at the cubital tunnel is latent and will emerge later or may appear only in case of extensive elbow use.

We are convinced that an elbow flexion test lasting 1 minute is able to evoke or worsen symptomatology of ulnar nerve compression at the cubital tunnel so that it becomes useful for the differential diagnosis with cervicobrachialgias and other pathologies which may simulate ulnar nerve compression at the cubital tunnel.

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SAMENVATTING

M. ROSATI, R. MARTIGNONI, G. SPAGNOLLI, C. NESTI, M. LISANTI. Klinische waarde van de elleboogflexietest bij de diagnose van cubital tunnel syndroom.

Bij 216 ellebogen zonder compressie van de nervus ulnaris in de cubital tunnel en zonder andere neuropathies, werd de elleboogflexietest nagegaan. De 4 posities van Rayan werden toegepast.

In 3,6% der gevallen was er na 4 minuten een positieve respons.

Na 3 minuten bedroeg dit 16,2%.

In dat opzicht besluiten wij dat de test met elleboogflexie gedurende 1 min. behulpzaam is in de diagnose van compressie van de nervus ulnaris in de cubital tunnel.

RÉSUMÉ

M. ROSATI, R. MARTIGNONI, G. SPAGNOLLI, C. NESTI, M. LISANTI. Valeur clinique du test de flexion du coude pour le diagnostic de compression du nerf cubital au coude.

Nous avons évalué l'intérêt du test de flexion du coude au niveau de 216 coudes chez des sujets qui ne pré-

sentaient aucun signe de compression du nerf cubital au coude et qui étaient indemnes d'autres neuropathies. Nous avons utilisé les 4 positions de Rayan. En maintenant la flexion du coude pendant une minute au maximum, le test était positif dans 3,6% des cas seulement. En évaluant, au contraire, le test de flexion à 3 minutes, il était positif dans 16,2% des cas. Nous pensons donc que la positivité du test de flexion du coude à 1 minute peut être un élément utile pour le diagnostic d'une compression du nerf cubital au coude.