Determinants of Anxiety and Depression in Patients with Cubital Tunnel Syndrome

siming jia
Hebei Medical University Third Affiliated Hospital

Xiaoying Shi
Hebei General Hospital

Guanglian Liu
Hebei pingshen general hospital

Li Wang
Hebei Medical University Third Affiliated Hospital

Xiaoran Zhang
Hebei Medical University Third Affiliated Hospital

Xuelin Ma
Hebei Medical University Third Affiliated Hospital

jia li
xuzhou renci hospital

xinzhong shao (shaoxzhong@126.com)
Hebei Medical University Third Affiliated Hospital

Research article

Keywords: Cubital tunnel syndrome, anxiety, seppression, neurophysiology, hospital based study

Posted Date: October 15th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-24784/v2

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Version of Record: A version of this preprint was published on November 17th, 2020. See the published version at https://doi.org/10.1186/s12888-020-02934-0.
Abstract

**Background:** This aim of the cross-sectional study were to assess the proportions of anxiety and depression in patients with cubital tunnel syndrome, and to explore the associated demographic and clinical features.

**Methods:** From May 2011 to January 2017, 246 patients diagnosed with CuTS were recruited. The Hospital Anxiety and Depression Scale was used to assess the proportions of depression and anxiety. Patient demographic and clinical data were collected. Univariate analysis and multivariate regression were carried out to identify the variables that were independently associated with anxiety and depression.

**Results:** The proportions of depression and anxiety were 18% (n=44) and 14% (n=35), respectively. Five patients had both possible/probable anxiety and depression. Logistic regression analysis revealed that diabetes mellitus was independently associated with depression; and the modifed McGowan grade was independently associated with anxiety.

**Conclusions:** In patients with CuTS, the proportions of depression and anxiety were 18% and 14%, respectively. Early screening for anxiety and depression is beneficial for patients with CuTS.

Background

Cubital tunnel syndrome (CuTS) is the second most common peripheral nerve entrapment syndrome, caused by compression of the ulnar nerve within the cubital tunnel at the elbow [1, 2]. Patients with CuTS are often troubled by symptoms like tingling and pain in the small finger and ulnar half of the ring finger [4]. As the condition progresses, muscular weakening and muscular atrophy will occur [5]. Owing to these symptoms, patients’ quality of life and the ability to continue employment may be impacted.

CuTS and depression are highly prevalent conditions, specifically among women [6]. In the general population, the global prevalence for major depressive disorder is 5%, whereas for anxiety disorders is 4% [7]. Mood disorders such as depression and anxiety increase the pain perceived and worsen the functional status [8]. Many published articles focus on disease progress, but few studies on patients’ mental status [9-13]. In a cross-sectional study, Van et al [14] found patients with disorders on the upper extremity were more frequently reported anxiety and depression. They reported the proportions of depressive and anxiety disorders were 16% and 9% in patients with CuTS. Therefore, it is important to assess the mental status of patients with CuTS.

This aim of the study were to assess the proportions of anxiety and depression in patients with CuTS, and to explore the associated demographic and clinical features.

Methods

**Participants**
From May 2011 to January 2017, patients diagnosed with CuTS were recruited from the outpatient service of the hospital. The number of variable was used to calculate the optimal number of participants for this study. In this study, the sample size was typically expressed in terms of events per variable. An events per variable of 10 was widely used as the low limit for developing the models that predicted a binary outcome [15]. The sampling method was convenient sampling. Diagnosis of CuTS was made using a combination of clinical evaluation and nerve conduction study. Clinical assessments included the history of initial presence with intermittent paresthesias, numbness, and tingling in the small finger and ulnar half of the ring finger [4]. According to the guideline of the American Association of Electrodiagnostic Medicine [16], all patients underwent the nerve conduction study. Confirmatory criteria included: (1) motor nerve conduction velocity (MNCV) across the elbow less than 50 m/s; (2) an MNCV difference of greater than 10 m/s between the elbow segment and forearm segment; (3) a conduction block with compound muscle action potential decreased more than 20% (amplitude measured from the elbow to upper arm). Electrodiagnostic studies were performed by a specialist technician using a Dantec Keypoint Portable Nerve Conduction/ electromyography machine (Dantec Dynamics, Bristol, Bristol, UK) and reported by a consultant neurophysiologist. The specific process is shown in Figure 1.

Patients were selected based on one of the following criteria: (1) patients with subjective symptoms, no matter the presence of intrinsic muscle atrophy or not; (2) electrodiagnostic evidences of CuTS; and (3) age > 18 years because the study just focused on adult patients. Patients with one of the following criteria were excluded: (1) age ≤ 18 years; (2) patients with other neuropathy confirmed electrophysiologically; (3) patients refused to attend the study; (4) patients who had undergone previous treatments, such as splinting, steroid injection, or cubital tunnel release; (4) a previous diagnosis of anxiety, depression, and other psychiatric disorder; (5) pregnant and lactating women because they were at high risks of depression and anxiety that distorted the assessments [17].

Demographics and Clinical Evaluation
We used the self-administered questionnaire to assess the patients, which consisted two parts. The first part included patients’ demographic data (age, gender, educational level, marital status, job status, and socioeconomic status). The second part were patients’ clinical data (hypertension, diabetes mellitus, tobacco use, alcohol use, history of cancer, and duration of symptoms). Patients were determined as older (> 50 years) and younger (≤ 50 years) adults. Educational level was registered as university degree, primary and middle degree, and illiterate degree. Marital status was coded as married, single (with or without cohabiting), widow, and divorced. Job status was registered as employed (in vacation or not) and unemployed (including students). According to the working experience in the major, we categorized the employed patients as unskilled (≤ 2 years), skilled (2 to 5 years), and professional (≥ 5 years) occupations. The socioeconomic status was recorded based on the total amount of family income, it was determined as high = earning more than 10,000 Ren Min Bi(RMB), medium = earning 50,001 to 10,000 RMB per year, or low = earning 1 to 5000 RMB per year. Duration of symptoms was determined as long (> 2 years) and short (≤ 2 years) terms. Based on the standard of World Health Organization, alcohol use
was defined as ≥ 60g on one occasion in the past 30 days [18]. Patients were asked to complete the Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) questionnaire to assess the hand function (0= no disability, 100= total disability) [19, 20]. It is a more quickly administered version of DASH, developed using Rasch analysis [20]. It has adequate convergent and discriminant validity, excellent internal consistency reliability with a Cronbach α of 0.89 in the primary care setting [21, 22]. Based on the modified McGowan grade [14], the patients were classified into four groups (grade I: subjective symptoms, no abnormal objective findings; grade IIa: good intrinsic strength (4/5), no detectable muscle atrophy; grade IIb: fair intrinsic strength (3/5), detectable muscle atrophy; grade III: profound sensory and motor disturbances with marked intrinsic atrophy). We used the 21-item Hospital Anxiety and Depression Scale (HADS) (≥ 11 points, probable disorder; 8 to 10, possible cases; and ≤ 7, no case) to determine the anxiety and depression [23]. It contains anxiety sub-scale (HADS-A) and depression sub-scale (HADS-D) with each including 7 questions. We classified the patients as being depressed or anxious (present case, ≥8 points) or nondepressed/nonanxious (absent case, ≤7 points). The cut-off scores of depression and anxiety were 8 points. In China, the validated HADS is commonly used for interviewing participants. The Chinese version of HADS demonstrated the similar satisfactory linguistic equivalence, conceptual equivalence, and scale equivalence (concordance rates at the cutoff of 8 for anxiety and depression sub-scales were 89% and 87%, respectively; and at the cutoffs of 11 were 87% and 91%, respectively) compared with the English version [24].

**Data Collection**

Data was collected by a clinical psychologist (XS) who filled out the pre-coded structured questionnaire that comprised demographic and clinical data collected from the patients.

**Statistical Analyses**

The main outcomes were the proportions of anxiety and depression, as well as the associated factors. Associations between potential prognostic determinants and outcomes were examined using univariate logistic regression analysis. Predictors univariately associated with outcome (p < 0.05) were included in a multiple-predictor logistic regression model. Then multiple logistic regression (Backword-Wald) was carried out to identify the variables that were independently associated with anxiety and depression. Logistic regression was expressed as odds ratios with a 95% confidence interval (CI). Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS, version 25, Chicago, IL) for windows.

**Results**
A total of 295 patients with typical electromyographic images of MNCV across the elbow (< 50 m/s) were recruited (Fig. 2). We excluded 49 patients because they refused to participate. Finally, 246 patients were included in this study with response rate of 83%. All patients provided complete data. The mean age was 63.0±3.8 years. There were 180 (73%) female patients; 166 (68%) patients had primary or middle education; 101 (41%) patients were in the medium socioeconomic level; 175 (71%) patients were married; 18 (7%) patients reported tobacco use; and 23 (9%) patients reported alcohol use. The most frequent medical comorbidities were diabetes mellitus (18%, n = 44) and hypertension (11%, n = 26). The average duration of symptoms was 23.9± 4.1 months. Based on modified McGowan grade, all patients were classified into grade I (n = 88), grade IIa (n = 45), grade IIb (n = 59), and grade III (n = 54) CuTS. The mean QuickDASH score was 48±4. The demographic and clinical characteristics are summarized in Table 1.

The results of the HADS demonstrated that 44 (17.8%) patients presented with possible/probable depression, and 35 (14.2%) patients presented with possible/probable anxiety. Five patients had both possible/probable anxiety and depression.

The factors associated with depression were education ($p<0.001$), job status ($p = 0.001$), and diabetes mellitus ($p < 0.001$). The factors associated with anxiety were diabetes mellitus ($p = 0.011$), modified McGowan grade ($p = 0.021$), and hypertension ($p = 0.024$). These factors are shown in Figure 3. The results of univariate logistic analysis are summarized in Table 2. Multivariable logistic analysis of univariate factors associated with depression and anxiety is shown in Table 3. Diabetes mellitus was independently associated with depression ($p < 0.001$). Modified McGowan grade was significantly associated with anxiety ($p < 0.001$).

**Discussion**

Many studies have shown that the chronic diseases, such as diabetes and asthma, can cause mental health disorders after a prolonged period of time [25]. Beleckas et al [13] found that the CuTS-related proportions of depressive and anxiety disorders were 16% and 9%, respectively, based on the National Institutes of Health developed the Patient-Reported Outcomes Measurement Information System. Anxiety may last for a long time before the medical intervention. Until now, few studies focus on the prevalence of depression and anxiety in patients with CuTS.

We found 18% of patients had significant symptoms of possible/probable depression disorder, and 14% had the symptoms of the possible/probable depressive disorder. Similarly, Belecka et al [13] also found that patients with the upper extremity conditions more frequently reported anxiety and depression than the general population did. Those findings are helpful for early psychiatric evaluation and identifying the presence of depression and anxiety in patients with CuTS.

Logistic regression analysis revealed that diabetes mellitus is independently associated with depression. Diabetes mellitus can cause small fiber neuropathy, which form a significantly painful condition in a patient's body [26]. Therefore, it is possible that the small fiber neuropathy worsens the symptoms of CuTS, and the cooperative effect increases the risk of depression.
In our study, the modified McGowan grade was independently associated with anxiety. We found a higher proportion of anxiety in patients with grade IIb (20%) and III (17%) CuTS, compared with that in patients with grade I (16%) and IIa (0) CuTS. Patients with anxiety tend to report worse hand function, and the worse hand function worsen their anxiety symptoms. This finding showed that worse anxiety is associated with higher symptom burden and worse physical functioning. Therefore, an early intervention is beneficial to stop the progression of the disease for patients with mental health disorders.

Our study has limitations. The sample size is small, which affects the comprehension of the questionnaires presented to those participants. There is a bias that the HADS is a screening tool for assessing anxiety and depression rather than a clinical diagnostic tool. Our study is based on one time point and is thus cross-sectional. Therefore, we are unable to determine the causal relationships, or establish the direction of associations.

**Conclusion**

In patients with CuTS, the proportions of depression and anxiety were 18% and 14%, respectively. Early screening for anxiety and depression is beneficial for patients with CuTS.

**Abbreviations**

| Abbreviation | Description                        |
|--------------|------------------------------------|
| CuTS         | Cubital Tunnel Syndrome            |
| RMB          | Ren Min Bi                         |
| QuickDASH    | Quick Disabilities of the Arm, Shoulder, and Hand |
| HADS         | Hospital Anxiety and Depression Scale |
| CI           | Confidence interval                |
| SPSS         | Statistical Package for the Social Sciences |

**Declarations**

**Ethics approval and consent to participate**

The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study complied with the Declaration of Helsinki and was approved by Ethics Committees of the Third Hospital of Hebei medical university. Except for illiterate patients, all patients provided written informed consent. Illiterate patients indicate their consent by "making their mark** on the consent form, which were consistent with the local law.

**Consent for publication**
The authors have no interests ethical, legal and financial conflicts related to the article. All authors read and approved the manuscript to publish.

**Availability of data and material**

All of the materials were provided by the Third Hospital of Hebei medical university, and anyone can obtain the materials with appropriate reasons.

**Competing interests**

The authors declare that they have no conflict of interest.

**Funding**

This work was supported by the Chinese Traditional and Western Medicine Clinical Collaborative Pilot Project for Major Difficult Diseases of the National Administration of Traditional Chinese Medicine "Degenerative Osteoarthritis of the Elbow Joint with Ulnar Nerve Entrapment Syndrome"

**Authors' contributions**

(I) Conception and design: XS, SJ

(II) Administrative support: XS, SJ

(III) Provision of study materials or patients: GL, LW

(IV) Collection and assembly of data: XZ, XM

(V) Data analysis and interpretation: XZ, XM, JL

(VI) Manuscript writing: All authors

(VII) Final approval of manuscript: All authors

All authors have read and approved the manuscript, and ensure that this is the case

**Acknowledgements**

We are particularly grateful to all the people who have given us help on our article.

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| Characteristics                        |     |
|----------------------------------------|-----|
| Age (year)                             | 63.1±3.8 |
| Gender, n (%)                          |     |
| Male                                   | 66(26.8) |
| Female                                 | 180(73.2) |
| Marital status, n (%)                  |     |
| Married                                | 175(71.1) |
| Single                                 | 1(0.4) |
| Divorced                               | 57(23.1) |
| Widowed                                | 13(5.2) |
| Education, n (%)                       |     |
| University                             | 55(22.3) |
| Primary and middle                     | 166(67.5) |
| Illiterate                             | 25(10.1) |
| Job status, n (%)                      |     |
| Unemployed (%)                         | 31(12.6) |
| Employed                               | 215(87.4) |
| Socioeconomic status, n (%)            |     |
| High                                   | 24(9.7) |
| Medium                                 | 101(41.1) |
| Low                                    | 121(49.2) |
| Tobacco use, n (%)                     | 18(7.3) |
| Exceeding permitted alcohol limit, n (%) | 23(9.3) |
| Hypertension, n (%)                    | 44(17.9) |
| Diabetes mellitus, n (%)               | 26(10.6) |
| History of cancer, n (%)               | 1(0.4) |
| Duration of symptoms (months)          | 23.9±4.1 |
| QuickDASH score                        | 48±4 |
| Modified McGowan grade, n (%)          |     |
| Grade I CTS                            | 88(35.8) |
| Grade IIa CTS                          | 45(18.2) |
| Grade IIb CTS                          | 59(23.9) |
| Grade III CTS                          | 54(21.9) |
| Demographic characteristics | N | Depression | Anxiety | | Present(n=44) | Absent(n=202) | Pvalue | Present(n=35) | Absent(n=211) | Pvalue |
|-----------------------------|---|------------|---------|----------|----------------|---------|-----------|------------|----------------|---------|-------|
| **Age, n (%)**              |   |            |         |          |                 |         |           |             |                 |         |       |
| >50 years old              | 181 | 31(70.5)   | 150(74.3) | 0.604    | 28(80)         | 153(72.5) | 0.352     |
| ≤50 years old              | 65  | 13(29.5)   | 52(25.7)  | 0.115    | 7(20)          | 58(27.5)  | 0.721     |
| **Gender, n (%)**          |   |            |         |          |                 |         |           |             |                 |         |       |
| Male                        | 66  | 16(36.4)   | 50(24.8)  | 0.604    | 5(14.3)        | 61(28.9)  | 0.071     |
| Female                      | 180 | 28(63.6)   | 152(75.2) | 0.115    | 30(85.7)       | 150(71.1) | 0.071     |
| **Marital status, n (%)**  |   |            |         |          |                 |         |           |             |                 |         |       |
| Married                     | 175 | 30(68.2)   | 145(71.8) |          | 23(65.7)       | 152(72.0) | 0.733     |
| Single                      | 1   | 0          | 1(0.5)   |          | 0              | 1(0.4)   |           |             |                 |         |       |
| Divorced                    | 57  | 10(22.7)   | 47(23.3)  | 0.001*   | 9(25.7)        | 47(22.2)  | 0.071     |
| Widowed                     | 13  | 4(9.1)     | 9(4.5)   |          | 3(8.5)         | 10(4.7)  |           |             |                 |         |       |
| **Education, n (%)**       |   |            |         |          |                 |         |           |             |                 |         |       |
| University                  | 55  | 19(43.2)   | 36(17.8)  |          | 6(17.1)        | 49(23.2)  |           |             |                 |         |       |
| Primary and middle school   | 166 | 21(47.7)   | 146(71.8) |          | 25(71.4)       | 141(66.8)|           |             |                 |         |       |
| Illiterate                  | 25  | 4(9.1)     | 21(10.4)  | 0.001*   | 4(11.4)        | 21(9.9)  | 0.721     |
| **Job status, n (%)**      |   |            |         |          |                 |         |           |             |                 |         |       |
| Unemployed                  | 31  | 12(27.3)   | 19(9.4)   |          | 5(14.3)        | 26(12.3)  |           |             |                 |         |       |
| Unskilled                   | 25  | 7(15.9)    | 18(8.9)   | 0.204    | 2(5.7)         | 23(10.9)  |           |             |                 |         |       |
| Skilled                     | 166 | 21(47.7)   | 145(71.8) |          | 25(71.4)       | 141(66.8)|           |             |                 |         |       |
| Professionals               | 24  | 4(9.1)     | 20(9.9)   | 0.003*   | 3(8.6)         | 21(10)   | 0.792     |
| **Socioeconomic status, n (%)** |   |            |         |          |                 |         |           |             |                 |         |       |
| High                        | 24  | 8(18.2)    | 16(7.9)   |          | 3(8.6)         | 21(10)   |           |             |                 |         |       |
| Medium                      | 101 | 15(34.1)   | 86(42.6)  |          | 10(28.6)       | 91(43.1)  |           |             |                 |         |       |
| Low                         | 121 | 21(47.7)   | 100(49.5) | 0.103    | 22(62.9)       | 99(46.9)  | 0.026     |
| **Clinical characteristics**|   |            |         |          |                 |         |           |             |                 |         |       |
| Diabetes mellitus, n (%)    | 44  | 18(40.9)   | 26(12.9)  | <0.001*  | 11(31.4)       | 33(15.6)  | 0.024     |
| Hypertension, n (%)         | 26  | 7(15.9)    | 19(9.4)   | 0.204    | 8(22.9)        | 18(8.5)  | 0.111     |
| Tobacco use, n (%)          | 18  | 4(9.1)     | 14(6.9)   | 0.618    | 4(11.4)        | 14(6.6)  | 0.313     |
| Alcohol use, n (%)          | 23  | 6(13.6)    | 17(8.4)   | 0.281    | 4(11.4)        | 19(9.0)  | 0.648     |
| History of cancer, n (%)    | 1   | 0          | 1(0.4)    | 0.75     | 1(2.8)         | 0        | 0.85      |
| **Duration of symptoms, n (%)** |   |            |         |          |                 |         |           |             |                 |         |       |
| >2 years                    | 124 | 25(56.8)   | 99(49)    |          | 18(60)         | 106(37.6)|           |             |                 |         |       |
| ≤2 years                    | 122 | 19(43.2)   | 103(51)   | 0.348    | 17(40)         | 105(37.6)| 0.896     |
| **QuickDASH score**         |   |            |         |          |                 |         |           |             |                 |         |       |
| Modified McGowan grade, n (%) |   |            |         |          |                 |         |           |             |                 |         |       |
| Grade I                     | 88  | 24(54.5)   | 64(33.7)  |          | 14(40)         | 74(35.1)  |           |             |                 |         |       |
| CuTS                        | 45  | 0          | 45(22.3)  | 0.003*   | 0              | 45(21.3)  |           |             |                 |         |       |
| Grade IIa                   | 59  | 11(25)     | 48(23.8)  | 0.003*   | 12(34.3)       | 47(22.3)  |           |             |                 |         |       |
| CuTS                        | 54  | 9(20.5)    | 45(22.3)  |          | 9(25.7)        | 45(21.3)  | 0.021     |

Chi-squared test was used, *P<0.05, # Fishers exact test was used
### Table 3. Logistic regression for variables associated with anxiety and depression

| Variable                  | β      | Odds ratio | 95% CI     | p value |
|---------------------------|--------|------------|------------|---------|
| **Depression**            |        |            |            |         |
| Job status                | -0.255 | 0.775      | 0.423-1.420| 0.409   |
| Education                 | 0.757  | 2.131      | 0.674-6.745| 0.198   |
| Modified McGowan grade    | 0.427  | 0.652      | 0.406-1.049| 0.078   |
| Diabetes Mellitus         | 1.950  | 7.029      | 2.065-23.920| 0.002*  |
| **Anxiety**               |        |            |            |         |
| Modified McGowan grade    | 0.533  | 0.587      | 0.378-0.911| 0.017*  |
| Diabettes millitus        | 0.799  | 2.222      | 0.499-9.894| 0.295   |
| Hypertension              | 1.378  | 3.965      | 0.804-19.568| 0.091   |

Multivariable logistic analysis was used, * P<0.05
Illiterate; unemployed and Grade III CTS were taken as a reference value in the calculation of Adjusted Odds Ratio for educational status, Job status and Modified McGowan grade

**Figures**
Figure 1

Flow chart of patients with CuTS who underwent HADS text
Figure 2

The picture of sample electrodiagnostic evidence of CuTS. A: patient with CuTS but without depression and anxiety symptoms. B: patient with both CuTS and depression symptoms. C: patient with both CuTS and anxiety symptoms.
Figure 3

Factors that were associated with depression in CuTS patients A: marital status, B: job status, C diabetes mellitus D: modified McGowan grade: Factors that were associated with anxiety in CuTS patients, E: hypertension, F: diabetes mellitus, G: modified McGowan grade.

Supplementary Files
This is a list of supplementary files associated with this preprint. Click to download.

- STROBEchecklistcrosssectional.doc