

# Epidemiology and Estimated Cost of Surgery for Cubital Tunnel Syndrome Conducted by the Unified Health System in Brazil (2005–2015)

## *Epidemiologia e estimativa de custo das cirurgias para síndrome do túnel cubital realizadas pelo Sistema Único de Saúde no Brasil (2005–2015)*

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### Abstract

**Introduction** Cubital tunnel syndrome (CTS) is responsible for one of the types of ulnar nerve neuropathy and is the second cause of compressive neuropathy of the upper limb, only surpassed by carpal tunnel syndrome.

**Objective** To describe the epidemiological data of the ulnar nerve transposition surgical code in the treatment of CTS by the United Health System (SUS) from 2005 to 2015.

**Methodology** This is a descriptive epidemiological study, in which data were obtained through consultation of the DATASUS database.

**Results/Discussion** During this period, 774 procedures were performed and, despite the addition of 20.3 million people to the Brazilian population, the incidence was 0.33/1,000,000. National and international epidemiology point to a slightly higher prevalence of the procedure between men, in the fourth and fifth decades of life. Low permanence rate, as well as the absence of hospital deaths related to the procedure, infer that the procedure is safe, with low morbidity and mortality rates.

**Conclusion** The annual incidence of the cubital syndrome submitted to surgical treatment at SUS in the Brazilian population was 1/7,670,833 in 2005 and 1/2,174,468 in 2015. The cost of each surgical procedure during the same period ranged from R\$ 318.88 to R\$ 539.74. The mean hospitalization time for CTS surgery was 1.85 days.

**Introdução** A síndrome do túnel cubital (STCB) é responsável por um dos tipos de neuropatia do nervo ulnar, sendo a segunda causa de neuropatia compressiva do membro superior, superada apenas pela síndrome do túnel do carpo.

**Objetivo** Descrever os dados epidemiológicos do código cirúrgico de transposição do nervo cubital no tratamento da STCB realizado pelo Sistema Único de Saúde (SUS), de 2005 a 2015.

### Keywords

- ▶ epidemiology
- ▶ cubital tunnel syndrome
- ▶ ulnar nerve

### Resumo

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**Palavras-chave**

- ▶ epidemiologia
- ▶ síndrome do túnel cubital
- ▶ nervo ulnar

**Metodologia** Trata-se de um estudo epidemiológico descritivo cujos dados foram obtidos por meio de consulta à base de dados disponibilizada pelo DATASUS.

**Resultado/Discussão** Foram realizados 774 procedimentos ao longo deste período, e, apesar do acréscimo de 20,3 milhões de pessoas à população brasileira, constatou-se incidência de 0,33:1.000.000. A epidemiologia nacional e internacional aponta para uma discreta prevalência do procedimento em homens, entre a quarta e quinta décadas de vida. A baixa taxa de permanência e a ausência de óbitos hospitalares relacionados ao procedimento atestam que este é seguro, com baixa taxa de morbimortalidade.

**Conclusão** A incidência anual da STCB na população brasileira submetida ao tratamento cirúrgico, pelo SUS, em 2005, foi de 1:7.670.833, e em 2015, de 1:2.174.468. Foram gastos, para cada procedimento cirúrgico, de 2005 a 2015, valores que oscilaram entre R\$ 318,88 e R\$ 539,74. Observou-se média de 1,85 dias de permanência hospitalar para a realização da cirurgia da STCB.

## Introduction

Cubital tunnel syndrome (CTS) is responsible for a type of ulnar nerve neuropathy and it is the second cause of compressive neuropathy of the upper limb, surpassed only by carpal tunnel syndrome. Since this nerve has a very long path in the upper limb, it can be compressed at several points, with the elbow region as the site of greatest impairment.<sup>1,2</sup>

Several etiologies are related to the development of CTS. These etiologies include metabolic alterations, congenital abnormalities, elbow trauma sequelae, tumors, osteoarthritis and nerve subluxation in the medial epicondyle during elbow flexion.<sup>3</sup>

Epidemiological data show that its worldwide incidence is estimated at 25 cases per 100,000 people/year, with men being affected twice more than women, and with the highest impairment between the fourth and fifth decades of life.<sup>1,2</sup>

Italy presents the same worldwide incidence: 25 cases per 100,000 people/year.<sup>4</sup> In Germany, studies show an incidence of 24.7 cases per 100,000 people/year, involving 2 men for each woman.<sup>5</sup> In the Netherlands, the annual incidence is 21 to 25 cases per 100,000 people.<sup>6</sup> In contrast, American epidemiological studies showed a higher incidence of CTS in women, around the 5th decade of life, affecting ~ 376 per 100,000 people/year. Annually, 75,000 decompression surgeries are performed in the United States.<sup>7,8</sup>

There are few CTS-related studies in the Brazilian population regarding variables such as age, gender, ethnicity, occupation and clinical characteristics of the patients submitted to the surgical procedure.

Diagnosis is based on signs and symptoms, sensory and motor tests and electromyography of the upper limbs. The patients affected by this syndrome often present paresthesia in the ulnar nerve distribution territory, paresis and/or hypotrophy of the hand intrinsic musculature. The extent of ulnar nerve dysfunction is classified by McGowan into three grades: grade I, isolated sensory neuropathy; grade 2, sensory and motor neuropathy without muscular atrophy;

grade 3, sensory and motor neuropathy with muscular atrophy.<sup>2,9</sup> Upper limb electromyography and clinical evaluation were considered the best parameters for the surgical decision making on CTS patients.<sup>2</sup>

Cubital tunnel syndrome treatment can be conservative or surgical, depending on the clinical signs and symptoms, according with the McGowan classification. Mild or moderate cases can be conservatively treated due to the potential of spontaneous regeneration. Surgical decompression is indicated in severe cases, or when there is no clinical improvement.<sup>9</sup>

Several surgical approaches are used in the treatment of ulnar neuropathy at the elbow, including simple decompression, endoscopic in situ decompression, ulnar nerve transposition (subcutaneous, intramuscular and submuscular), and medial epicondilectomy.<sup>3,10,11</sup> Although the best surgical technique is debated, the anterior transposition is the most used technique.<sup>12</sup>

## Objective

To describe the epidemiological data regarding the number of annual procedures, hospital costs, hospitalization time and number of deaths of patients admitted by the Unified Health System (SUS), from 2005 to 2015, using the surgical code of ulnar nerve transposition.

## Methodology

This is a descriptive epidemiological study with data obtained from the Information Technology Department of the Brazilian Public Health Care System (DATASUS, in the Portuguese acronym) database (<http://www.datasus.gov.br>) accessed in August and September 2016. The study population was composed of all patients submitted to ulnar nerve transposition (code 0403020107) from January 2005 to December 2015. The DATASUS data were tabulated using the SPSS 13.0 software (SPSS Inc., Chicago, IL, USA). Since

DATASUS is a public domain database, the project submission to the Research Ethics Committee was not required. Subsequently, a bibliographical survey was performed in scientific databases, searching for both Brazilian and international publications, in PubMed, BVS (*Biblioteca Virtual de Saúde*, Virtual Health Library), LILACS (*Literatura Latino-Americana e do Caribe em Ciências da Saúde*, Latin American and Caribbean Literature in Health Sciences), MEDLINE (National Library of Medicine) and SciELO (Scientific Electronic Library Online) with the following descriptors: epidemiology, cubital and syndrome. To narrow the search, only articles published between 2010 to 2016 were considered. The following inclusion criteria were used: indexed journals published in national and international journals, written in English and Portuguese.

The exclusion criteria considered papers whose titles and summaries did not fit the objectives of the research. From the defined strategy, the bibliographic search resulted in a final sample consisting of 20 publications, 8 indexed in the LILACS database, 5 in the MEDLINE database, and 7 in the SciELO database. The studies were carefully and completely read, and then selected for strictly meeting the inclusion criteria and deemed relevant to be part of the proposed study.

## Results

► **Table 1** presents data on surgical procedures using the ulnar nerve transposition technique from January 2005 to December 2015. From the total of 774 procedures, 140 occurred in 2012, the year with the highest number of cases, representing 18.09% of the sample. There was an increase of 70 procedures between 2005 and 2015, representing an addition of 295.8%. In a comparative analysis of the number of procedures in this same period and the Brazilian popula-

**Table 1** Total distribution of the number of ulnar nerve transposition procedures between 2005 and 2015 in the Unified Health System (SUS)

Year	Total AIH	%
2005	24	3.10
2006	42	5.43
2007	24	3.10
2008	64	8.27
2009	63	8.14
2010	65	8.40
2011	77	9.95
2012	140	18.09
2013	87	11.24
2014	94	12.14
2015	94	12.14
Total	774	100

Source: <http://www2.datasus.gov.br/DATASUS/index.php?area=02>.

**Table 2** Annual incidence of patients with cubital tunnel syndrome submitted to surgical treatment between 2005 and 2015 in the Unified Health System (SUS)

Year	Total AHS	Brazilian population (million)	Incidence
2005	24	184.1	1:7,670,833
2006	42	186.7	1:4,445,238
2007	24	183.9	1:7,662,500
2008	64	189.6	1:2,962,500
2009	63	190.7	1:3,026,984
2010	65	191.4	1:2,944,615
2011	77	192.3	1:1,497,402
2012	140	193.9	1:1,385,000
2013	87	201.0	1:2,310,344
2014	94	202.7	1:2,156,382
2015	94	204.4	1:2,174,468

Abbreviation: AHS, authorization for hospital stay.

Source: <http://www2.datasus.gov.br/DATASUS/index.php?area=02>.

tion, it was observed that, even with the population increase, the annual incidence of patients submitted to surgery remained low, ranging from 1 case per 1,385,000 inhabitants to 1 case per 7,670,833 inhabitants (► **Table 2**).

► **Table 3** shows the quantitative analysis by geographical region. Most surgeries occurred in the Southeast region, with 459 procedures, representing 59.3% of the total. In the Northern region, 18 surgical procedures were performed, the smallest amount among regions, corresponding to 2.32%. The total and average values of procedural costs, as well as hospital and professional costs, are shown in ► **Table 4**. The average hospital cost oscillated from R\$ 315.23, the lowest value in 2005, to R\$ 515.25, the lowest value in 2015, evidencing an increase of 63.44%. ► **Table 5** shows the data regarding the average number of hospitalization days, as well as the number of deaths. These data show a variation of 0.7 day in 2012 and 3.5 days in 2009, with an overall average of 1.85 days. No deaths occurred throughout the study period.

**Table 3** Distribution of the number of ulnar nerve transposition procedures performed in the Unified Health System (SUS) between 2005 and 2015 per region

Region	Number	%
North	18	2.33
Northeast	65	8.40
Southeast	459	59.30
Central West	50	6.46
Total	774	100

Source: <http://www2.datasus.gov.br/DATASUS/index.php?area=02>.

**Table 4** Distribution of the actual costs, in Brazilian currency, of ulnar nerve transposition procedures performed in the Unified Health System (SUS) between 2005 and 2015 per region

Year	Total value	Average value	Hospital services cost	Professional services cost
2005	7,653.15	318.88	4,285.71	2,352.65
2006	13,568.02	323.05	7,616.77	4,094.25
2007	7,957.53	331.56	4,484.07	2,344.19
2008	28,017.92	437.78	17,389.13	10,628.79
2009	27,633.80	438.63	17,204.90	10,428.90
2010	28,770.11	442.62	17,645.43	11,124.68
2011	38,797.30	503.86	20,862.28	17,935.02
2012	72,725.95	519.47	37,963.39	34,762.56
2013	45,265.36	520.29	23,436.17	21,571.57
2014	52,059.84	553.83	27,390.03	23,381.67
2015	50,735.42	539.74	25,812.66	23,369.12

Source: <http://www2.datasus.gov.br/DATASUS/index.php?area=02>.

**Table 5** Mean distribution of hospitalization days and number of deaths related to ulnar nerve transposition procedures performed in the Unified Health System (SUS) between 2005 and 2015

Year	Average hospitalization days	Deaths
2005	2.1	–
2006	2.1	–
2007	1.8	–
2008	1.8	–
2009	3.5	–
2010	1.9	–
2011	1.4	–
2012	0.7	–
2013	1.2	–
2014	1.8	–
2015	2.1	–
Average	1.85	–

Source: <http://www2.datasus.gov.br/DATASUS/index.php?area=02>.

► **Table 6** shows the distribution of the number of procedures per type/code performed for CTS treatment, as well as other codes that could be used for both CTS and other peripheral nerve compressive conditions. From 2005 to 2007, procedures were performed with the following codes: ulnar nerve transposition (procedure code: 0403020107) and neurolysis (procedure code: 40200043). Starting in 2008, three other codes have passed to be adopted: nonfunctioning neurolysis of peripheral nerves (code procedure: 0403020077), microneurolysis of peripheral nerve (procedure code: 0403020050) and surgical treatment of neuropathy compressive with or without microsurgery (procedure code: 0403020115).

## Discussion

A total of 774 surgical procedures were performed using the ulnar nerve transposition technique (procedure code: 0403020107) from January 2005 to December 2015. This is considered the only specific code for the surgical treatment of the cubital tunnel syndrome available by SUS according to data obtained through the information system.

During the study period, there was a significant increase in the use of the ulnar nerve transposition technique, since 24 procedures were performed in 2005 and 94 procedures in 2015, showing a 295.8% increase.

The Brazilian population increased in 20.3 million individuals during the period studied. The annual incidence in 2005, when the estimated population was 184.1 million people, was 0.13:1,000,000, and, in 2015, when the population was 204.4 million, 0.46:1,000,000. The highest incidence was noted in 2012, with 0.72:1,000,000 inhabitants. Finally, the annual average incidence of cubital tunnel syndrome was 0.33:1,000,000.

A European study, performed at Centro Hospitalar do Tâmega e Sousa, in Portugal, evaluated 36 patients (17 men and 19 women) diagnosed with CTS who underwent ulnar nerve transposition from 2006 to 2009. The mean age of the patients was 41.6 years old (23–72 years old). Of these, 78% of patients presented severe neuropathy and improved after surgery, with a satisfaction rate of 86%, and with 72% returning to daily activities without limitations.<sup>3</sup>

In Asia, a study conducted in Korea from 2010 to 2012, with 69 patients submitted to ulnar nerve transposition surgery, showed that their mean age was 36 years-old and there was a male prevalence (59%).<sup>13</sup>

In the United States, a study with 25 patients (14 men and 11 women) undergoing surgery between 2003 and 2009 observed that their mean age was 53 years-old. In this study, 20 patients were submitted to unilateral surgery and 5 to bilateral surgery.<sup>14</sup>

**Table 6** Distribution of the number of procedures performed from 2005 to 2015 in the Unified Health System (SUS) specifically for cubital tunnel syndrome (CTS) treatment in addition to other procedures not specific for this condition

Year	Ulnar nerve transposition	Nonfunctional peripheral nerve neurolysis	Peripheral nerve microneurolysis	Surgical treatment*	Neurolysis	Total
2005	24	–	–	–	932	956
2006	42	–	–	–	1,181	1,223
2007	24	–	–	–	899	923
2008	64	3,123	4,376	5,151		12,714
2009	63	3,453	5,024	6,015		14,555
2010	65	3,157	4,874	5,988		14,084
2011	77	3,049	4,934	6,532		14,592
2012	140	3,291	5,059	7,139		15,629
2013	87	3,021	4,821	7,156		15,085
2014	94	3,134	4,918	7,064		15,210
2015	94	3,917	6,413	8,508		18,932
Total	774	26,145	40,419	53,553	3,012	123,903

\*surgical treatment of compressive neuropathy with or without microsurgery.  
Source: <http://www2.datasus.gov.br/DATASUS/index.php?area=02>.

In a Brazilian study performed between 2001 and 2006 at the Institute of the Hand of Universidade Federal de São Paulo (Unifesp) with 21 CTS patients treated with ulnar nerve transposition surgery, 12 individuals (57.1%) were male. The mean age of the patients was 51.6 years old.<sup>15</sup> Still in Brazil, at Hospital Sarah Brasília, 58 cases were studied between 2001 and 2007 and 6 cases were bilaterally operated. In this study, a female predominance and the preponderance of the 40 to 50 years old age group were observed.<sup>16</sup>

Based on the above-mentioned studies, it can be inferred that the national and international epidemiology points to a discrete prevalence of the ulnar nerve transposition procedure in men between the fourth and fifth decades of life. However, data on annual prevalence and incidence, as well as hospital costs, are still scarce.

The quantitative analysis by region showed the following: the North region had the lowest number of surgeries (18), while the Southeast region had the largest number (459), accounting to 59.30% of the total. These data suggest that some factors could justify this difference, such as population density, work activity type, access to health care and the ability of the medical professional to recognize the condition.

According to DATASUS, R\$ 7,653.15 were spent on CTS surgeries in 2005, with an average cost of R\$ 318.88 per procedure. In 2015, the total expense was R\$ 50,735.42, or R\$ 539.74 per procedure, showing an increase of 69.25% in the average hospital cost of this surgery. It is noteworthy that, according to SUS, R\$ 432.60 were paid per procedure between 2008 and 2011, with an increase to R\$ 515.25 starting on 2012, corresponding to a 19.1% increase.

Regarding the mean number of hospitalization days, also defined as the minimum hospitalization rate, we observed an oscillation between 0.7 days in 2012 to 3.5 days in 2009, with an overall mean of 1.85 days of hospitalization associated to

the surgical procedure. It is noteworthy that the death rate during the study period was zero.

It is important to consider that some segments were excluded from the analysis proposed by this study: patients coming from the private health network; CTS patients submitted to clinical treatment, with no need for surgical procedure; and CTS patients who underwent surgical treatment using other codes available at SUS (neurolysis, non-functioning peripheral nerve neurolysis, peripheral nerve microneurolysis and compressive neuropathy treatment with or without microsurgery). These last four codes totaled 120,117 procedures during the studied period. From the total above, it is possible to infer that there is a procedural fraction not quantified for CTS. As such, it is possible to affirm that the present study data could be underestimated.

## Conclusion

The annual incidence of cubital tunnel syndrome in the Brazilian population submitted to surgical treatment in the SUS between 2005 and 2015 was 0.33:1,000,000. Each surgical procedure cost between R\$ 318.88 and R\$ 539.74 during this period. The mean hospitalization time for CTS surgery was 1.85 days. The death rate was null during the study period. New epidemiological studies should involve the population coming from the private health sector as well as clinically treated CTS patients.

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