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Original Article

Effects of surgical treatment for trigeminal neuralgia and influence factors: a study based on patients treated at a first-class hospital in Henan Province

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Abstract: Objective: To discuss the effect of surgical treatment for trigeminal neuralgia and the influence factors through panel data analysis. Methods: From 2008 to 2010, 418 cases treated at our hospital for trigeminal neuralgia were reviewed; 314 cases were treated surgically, and 104 cases received other treatments. The treatment effect was assessed and the influence factors were analyzed. Statistical analysis was conducted using SPSS 17.0 software. Measurements were presented as mean ± standard deviation, and counts as percentages and constituent ratios. Results: The outcome of surgical and non-surgical treatments for trigeminal neuralgia was generally good, and the effect of surgical treatment was better; the cure rate was 97.13% vs. 85.58%. The distributions of percentages of patients who were cured, improved and not cured differed among those negative or positive for hepatitis C virus antibody (HCV-Ab); however, the distributions did not differ significantly by gender, age and marital status. The cure rate and improvement rate among patients positive for the HCV-Ab were 71.43% and 28.57%, respectively; for patients negative for HCV-Ab, the cure rate and improvement rate were 97.35% and 1.66%, respectively; there was one case who was not cured. The mean age, number of admission to hospital, and number of hospitalization days did not differ significantly. Regression analysis was performed to identify the influence factors of surgical treatment effect. It was found that the longer the hospital stay, the higher the cure rate with the surgical treatment would be. The probability of curing trigeminal neuralgia by surgical treatment for those positive for HCV-Ab was 28.7% of that for the negative cases; moreover, the factors of being positive for HCV-Ab, payment by medical insurance, male gender and longer hospital stay interacted with each other in the influence on the cure rate. Conclusion: Surgical treatment is superior to non-surgical treatment for trigeminal neuralgia. The influence factors of the treatment effect included hospital stay and concurrent diseases.

Keywords: Trigeminal neuralgia, surgical treatment, effect, influence factors

Introduction

Neuropathic pain is one of the greatest challenges in chronic pain management and it is divided into central and peripheral by origin. Trigeminal neuralgia is one of the most common peripheral neuropathic pains and characterized by acute, paroxysmal facial pain. Severe cases may suffer from reflexive twitching of the facial muscles, sometimes with the mouth corner pulling up to one side. The pain occurs suddenly as a brief episode lasting a few seconds at a time. Very few patients have reported episodes of pain lasting for a dozens of minutes or hours [1, 2]. The incidence of chronic pain varies from 10% to 20% across different populations. One panel survey in Sweden shows that the incidence of pain and chronic pain among local populations is 49% and 54%, respectively [1-3]. Chronic pain also brings about psychological problems such as depression, and the more severe the pain, the more severe the associated symptoms. Therefore, an effective treatment of chronic pain not only relieves the physical and psychological burden of the patients, but also reduces the consumption of public health resources allocated to treat chronic pain. Now chronic pain has become the third greatest health concern worldwide after cerebrovascular and cardiovascular diseases and cancers [1-4].

Table 1. Comparison of outcome of surgical and non-surgical treatments for trigeminal neuralgia

	Surgical	Non-surgical	Total
Cured	305 (97.13)	89 (85.58)	394 (94.26)
Improved	6 (1.91)	8 (7.69)	14 (3.35)
Not cured	3 (0.96)	7 (6.73)	10 (2.39)
χ^2=19.80, P<0.001*			

*P<0.01.

The treatment effect for trigeminal neuralgia is less satisfactory as the knowledge about the pathogenesis if limited. Conventional medications can only relieve the pain temporarily, while local blocking of the peripheral branch of the trigeminal nerve performed in Stomatology Department has a high recurrence rate. Surgical treatments for trigeminal neuralgia have been increasingly applied recently, and microvascular decompression is commonly used. This surgical approach can preserve the nerve function and reduce the risk of permanent neurological dysfunction. But the surgery raises a higher demand on the skills and may cause dysesthesia, anesthesia dolorosa and corneal neural paralysis. Trigeminal sensory rhizotomy enables a selective resection of the sensory root while preserving the motor root, which cures pain and preserves mastication. Subtemporal-epidural approach and subtemporal-subdural approach are most common used for this procedure. The posterior cranial fossa approach, which has been phased out recently, is similar to the sensory root resection in that both are destructive and hence may cause complications such as facial anesthesia. Some new treatments are emerging for trigeminal neuralgia such as radiofrequency ablation, which targets the unmyelinated trigeminal nerve fibers. The unmyelinated nerve fiber will be denatured at 70°C, while the denaturation of myelinated nerve fiber requires a higher temperature, thus achieving a selective ablation without damaging the sense of touch [1, 3, 4].

This study analyzed the effect of surgical treatment for trigeminal neuralgia and discussed the influence factors.

Materials and methods

From 2008 to 2010, 418 cases treated at our hospital for trigeminal neuralgia were reviewed; 314 cases were treated surgically, and 104 cases received other treatments. Trigeminal neuralgia was diagnosed mainly by clinical manifestations. Most patients did not present with obvious abnormalities, and a few had facial hypoesthesia. Past history of diseases was inquired, especially the history of hypertension. The patients received comprehensive examinations of the nervous system, including lumbar puncture, X-ray scan of skull base and internal auditory meatus, CT scan and MRI imaging of the head. A differentiation was made from secondary trigeminal neuralgia. The following conditions were excluded: cancer-related pain; headache and visceral pain; inability to comprehend the questions. All patients signed the informed consent.

Statistical analysis was carried out using SPSS 17.0 software. Measurements were presented as mean ± standard deviation, and counts as percentages and constituent ratios. If the data were in normal distribution, they were compared by the independent sample t-test; otherwise, rank sum test was used. Counts were compared by using the chi-square test. Influence factors of the treatment effect were identified by regression analysis. P<0.05 was considered significant difference.

Results

The outcome of surgical and non-surgical treatments for trigeminal neuralgia was generally good, and the effect of surgical treatment was better; the cure rate was 97.13% vs. 85.58%. The cure rate and non-cure rate for non-surgical treatment were 85.58% and 6.73%, respectively (**Table 1**).

The distributions of percentages of patients who were cured, improved and not cured differed among those negative or positive for HCV-Ab; however, the distributions did not differ significantly by gender, age and marital status. The cure rate and improvement rate among patients positive for HCV-Ab were 71.43% and 28.57%, respectively; for patients negative for HCV-Ab, the cure rate and improvement rate were 97.35% and 1.66%, respectively; there was one case who was not cured (1.66%). The mean age, number of admission to hospital, and number of hospitalization days did not differ significantly. See **Tables 2** and **3**.

Table 2. Distributions of the effective rate of surgical treatment (counts) (cases, constituent ratios)

	Cured	Improvement	Not cured	Total	
Gender					χ^2=0.289, *P*>0.05
Male	123 (95.35)	3 (2.33)	3 (2.33)	129 (100.00)	
Women	182 (98.38)	3 (1.62)	0 (0.00)	185 (100.00)	
Years					χ^2=3.913, *P*>0.05
2008 year	35 (94.59)	1 (2.70)	1 (2.70)	37 (100.00)	
2009 year	108 (98.18)	1 (0.91)	1 (0.91)	110 (100.00)	
2010 year	162 (97.01)	4 (2.40)	1 (0.59)	167 (100.00)	
Age (years old)					χ^2=6.867, *P*>0.05
<30	1 (100.00)	0 (0.00)	0 (0.00)	1 (100.00)	
30-	13 (92.86)	0 (0.00)	1 (7.14)	14 (100.00)	
40-	50 (98.04)	1 (1.96)	0 (0.00)	51 (100.00)	
50-	78 (96.30)	2 (2.47)	1 (1.23)	81 (100.00)	
60-	163 (97.60)	3 (1.80)	1 (0.60)	167 (100.00)	
Occupation					χ^2=2.275, *P*>0.05
Mental labor	10 (100.00)	0 (0.00)	0 (0.00)	10 (100.00)	
Mental and physical labor	87 (95.60)	3 (3.30)	1 (1.10)	91 (100.00)	
Physical labor	194 (97.98)	2 (1.01)	2 (1.01)	198 (100.00)	
Marriage					χ^2=0.305, *P*>0.05
In marriage	295 (97.04)	6 (1.97)	3 (1.52)	304 (100.00)	
Other	10 (100.00)	0 (0.00)	0 (0.00)	10 (100.00)	
Hospitalization fee difference					χ^2=0.683, *P*>0.05
Medical insurance	56 (98.25)	1 (1.75)	0 (0.00)	57 (100.00)	
Cost	249 (96.89)	5 (1.95)	3 (1.17)	257 (100.00)	
HCA-Ab					χ^2=5.785, *P*<0.05*
Positive	5 (71.43)	2 (28.57)	0 (0.00)	7 (100.00)	
Negative	294 (97.35)	5 (1.66)	3 (0.99)	302 (100.00)	
HBsAg					χ^2=1.989, *P*>0.05
Positive	14 (93.33)	1 (6.67)	0 (0.00)	15 (100.00)	
Negative	286 (97.28)	5 (1.70)	3 (1.02)	294 (100.00)	

*P<0.05.

Table 3. Distributions of effective rate of surgical treatment (measurements) (mean ± standard deviation)

	Cured	Improvement	Not cured	Total	
Age	60.09±11.93	62.00±11.76	59.33±21.50	60.12±11.98	F=0.09, *P*>0.05*
The number of admission	1.02±0.17	1.00±0.01	1.00±0.01	1.02±0.17	F=0.06, *P*>0.05*
Hospitalization days	6.45±2.84	5.83±1.84	9.00±2.56	6.46±2.87	F=1.36, *P*>0.05*

*P>0.05.

Regression analysis was performed, and the result showed that the longer the hospital stay, the higher the cure rate with the surgical treatment would be. The probability of curing trigeminal neuralgia by surgical treatment for those positive for HCV-Ab was 28.7% of that for the negative cases (**Table 4**).

The factor of longer hospital stay may interact with some other factors. Therefore we further analyzed the interactions of this factor with being positive for HCV-Ab, payment by medical insurance and male gender. It was found that when the factor of longer hospital stay coexisted with these three factors, the positive effect

Table 4. Influence factors of the cure rate of surgical treatment

Variable	Beta	S.E.	OR (95% CI)	*P* Value
Male gender	0.089	0.152	1.093 (0.811-1.472)	0.559
Elder age	-0.341	0.284	0.711 (0.408-1.240)	0.230
Mental labor	0.373	1.122	1.452 (0.161-13.101)	0.740
Married	-0.374	0.811	0.688 (0.140-3.374)	0.645
Longer hospital stay	0.640	0.134	1.897 (1.459-2.466)	<0.001**
Payment by medical insurance	-0.059	0.374	0.943 (0.453-1.961)	0.875
Positive for HCV-Ab	-1.247	0.568	0.287 (0.094-0.874)	0.028*
Positive for HbsAg	0.411	0.577	1.509 (0.487-4.672)	0.475

*P<0.05, **P<0.01.

was greatly abolished by the interactions with these three factors (**Table 5**).

Discussion

Neuropathic pain mainly causes pain and paresthesia, and the pain is either spontaneous or induced. Spontaneous pain usually occurs in the absence of external stimuli, while trigeminal neuralgia is an induced pain which involves hyperalgesia. Trigeminal nerve is either of a pair of large mixed nerves that are the fifth cranial nerves and supply the somatosensory fibers and visceral motor fiber. The trigeminal nerve governs the facial muscles, including the sensation of the oral and nasal cavities and movement of the masticatory muscles; it also sends the sensation from the head to the brain. Ophthalmic, maxillary and mandibular branches of the trigeminal nerve govern the sensory muscles and masticatory muscles above the palpebral fissure, between the palpebral fissure and oral fissure, and below the oral fissure, respectively. Trigeminal neuralgia mainly affects people aged above 40, with more female patients than male patients. The overall incidence is about 1.8‰, and the peak age of onset is between 50 and 60. The pain is mainly unilateral initially and more common on the right than on the left; only a few cases have bilateral pain. The pain generally spreads from maxillary or mandibular branch from one side to two or three branches of the trigeminal nerve. Although the pathogenesis of trigeminal neuralgia is uncertain, many would support the hypothesis that the pain is caused by the compression of the trigeminal nerve root by the microvessels. Another popular hypothesis is that the trigeminal nerve root is compressed and pulled by adjacent arteries or bulging satellite veins [5, 6].

Medications are the first choice for trigeminal neuralgia. Although the medicines do work at the beginning, the treatment effect deteriorates with time while the side-effects become more apparent, sometimes with drug resistance. Surgical treatment is considered for these patients, such as thorough curettage of a pathological lesion from the bone. This is because a pathological lesion is usually found in the mandible bone. Microvascular decompression and peripheral neurectomy are also among the most commonly used techniques [7-10]. These approaches were adopted to treat trigeminal neuralgia for the included cases depending on their conditions. As compared with the non-surgical treatment, surgical treatment achieved a better outcome, and the cure rate was 97.13% vs. 85.58%. The distributions of percentages of patients who were cured, improved and not cured differed among those negative or positive for HCV-Ab; however, the distributions did not differ significantly by gender, age and marital status. The cure rate and improvement rate among patients positive for HCV-Ab were 71.43% and 28.57%, respectively; for patients negative for HCV-Ab, the cure rate and improvement rate were 97.35% and 1.66%, respectively; there was 1 case (0.99%) who did not benefit from the treatment. Apparently, surgical treatment is very effective for trigeminal neuralgia.

We also analyzed the influence factors of surgical treatment effects using the regression model, which has been rarely done before. It was found that the longer the hospital stay, the higher the cure rate with the surgical treatment would be. The probability of curing trigeminal neuralgia by surgical treatment for those positive for HCV-Ab was 28.7% of that for the negative cases. According to other studies, past history of diseases and symptoms also correlates to the surgical treatment effect [11-15]. Patients with longer hospital stay may receive more professional nursing and health guidance on rehabilitation, which contribute to the treatment outcome. Chronic diseases also affect the working ability of the patients, and the stag-

Table 5. Interactions between different influence factors

Variable 1	Variable 2	OR	OR (alone)	OR (combined)	*P* Value
Longer hospital stay	Positive for HCV-Ab	1.591	2.592	4.758	<0.001*
Longer hospital stay	Payment by insurance	1.832	3.494	7.673	<0.001*
Longer hospital stay	Male gender	1.402	3.909	4.632	<0.001*

**P*<0.01.

geringly high medical expenses may be unacceptable for some families. The urban employees' basic medical insurance system in China has covered some chronic diseases, and the special outpatient management system for chronic diseases has been established. This has greatly relieved the economic burden from the patients. But according to the Opinions on Promoting the Equal Access to Basic Public Health Services released by the Ministry of Health and the Ministry of Finance, only hypertension and type 2 diabetes are covered. China has implemented a special free medical insurance program at the urban and rural grassroots health care institutions, which is covered by government budget only on condition that the grassroots health care institutions have passed the inspection. Although these public health care services bring benefits to the chronic disease patients [5, 14], we are uncertain about their impact on the surgical treatment for trigeminal neuralgia. In this study, the data related to medical insurance were collected for the interaction analysis. The factor of longer hospital stay was identified as a positive factor, and its interactions with being positive for HCV-Ab, male gender and payment by medical insurance were further analyzed in a pairwise manner. The result showed that the factor of longer hospital stay interacted with the other three factors in its influence on the cure rate. To the best of our knowledge, the effect of being positive for HCV-Ab on the cure rate for trigeminal neuralgia has not been discussed before. However, whether the correlations between the influence factors have a biological basis remains unknown.

To conclude, surgical treatment achieves a better effect than non-surgical treatments for trigeminal neuralgia, and the influence factors of the treatment effect include length of hospital stay and concurrent diseases. The factor of longer hospital stay interacted with the factors of being positive for HCV-Ab, payment by medical insurance and male gender.

Disclosure of conflict of interest

None.

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