



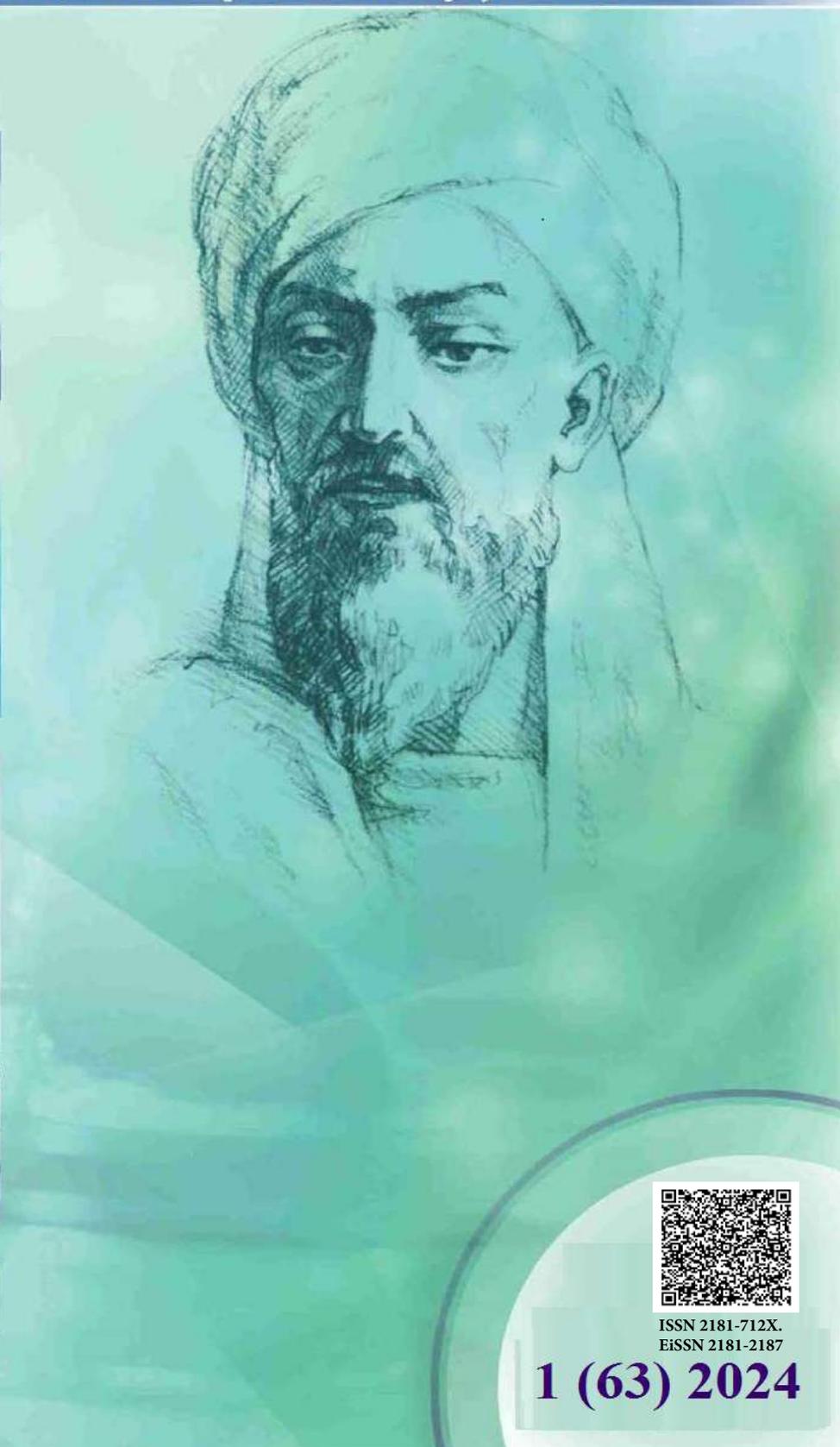
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NEW DAY IN MEDICINE**

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EFFICIENCY OF THALAMIC THERMAL ABLATION WITH MRI-GUIDED FOCUSED
ULTRASOUND IN PATIENTS WITH ESSENTIAL TREMOR

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✓ *Resume*

Background. We observed 40 patients with essential tremor who received unilateral thalamic thermal ablation using focused ultrasound under visual control of magnetic resonance imaging.

Methods. The patients were examined and diagnosed with "essential tremor" with the identification of the questionnaire total score severity of essential tremor.

Results. When comparing the results obtained in patients before and after treatment, a significant improvement in the total ET score was obtained in both women and men. However, it should be noted that ET parameters associated with the left hand (left hand tremor, left hand drawing, left hand drinking) remained unchanged, which is most likely associated with unilateral thalamic thermal ablation.

Conclusions. Treatment of essential tremor with MRI-guided focused ultrasound is an effective and safe treatment option. However, it does not affect the tremor on the opposite side of the thalamic thermal ablation and has reversible complications in a small proportion of patients during the thalamic thermal ablation procedure and some persistent side effects from the treatment.

Keywords: essential tremor, unilateral thalamic thermal ablation, focused ultrasound, magnetic resonance imaging

ЭФФЕКТИВНОСТЬ ТАЛАМИЧЕСКОЙ ТЕРМОАБЛЯЦИИ УЛЬТРАЗВУКОМ ПОД
ВИЗУАЛЬНЫМ КОНТРОЛЕМ МАГНИТНО-РЕЗОНАНСНОЙ ТОМОГРАФИИ ПРИ
ЭССЕНЦИАЛЬНОМ ТРЕМОРЕ

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✓ *Резюме*

Под нашим наблюдением находилось 40 пациентов с эссенциальным тремором, получавших одностороннюю таламическую термоабляцию с помощью сфокусированного ультразвука под визуальным контролем магнитно-резонансной томографии.

Методы. Больные были обследованы и выставлен диагноз «эссенциальный тремор» с выявлением по вопроснику общего балла выраженности эссенциального тремора.

Результаты. При сравнении полученных результатов у больных до и после лечения были получены достоверное улучшение общего балла ЭТ как у женщин, так и у мужчин. Однако, надо отметить, что параметры ЭТ связанные с левой рукой (тремор левой руки, рисование левой рукой, питье левой рукой) остались без перемен, которая, скорее всего, связана с односторонней таламической термоабляцией.

Заключение. Лечение эссенциального тремора фокусированным ультразвуком под контролем МРТ является эффективным и безопасным методом лечения. Однако, не оказывает воздействия на тремор с противоположной стороны термоабляции таламуса и имеет у незначительной части больных обратимые осложнения во время проведения процедуры таламической термоабляции и некоторых стойких побочных эффектах от проведенного лечения.

Ключевые слова: эссенциальный тремор, односторонняя таламическая термоабляция, сфокусированный ультразвук, магнитно-резонансная томография

ESSENTSIAL TREMORDA MAGNIT-REZONANS TOMOGRAFIYANING VIZUAL NAZORATI OSTIDA FOKUSLANGAN ULTRATOVUSH YORDAMIDA BIR TOMONLAMA TALAMIK TERMAL ABLASIYANI SAMARADORLIGI

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²Toshkent pediatriya tibbiyot instituti, O'zbekiston 100140, Toshkent, Bog'ishamol ko'chasi 223, tel: 8 71 260 36 58 E.mail: interdep@tashpmi.uz**Abstrakt**

✓ *Rezyume*

Biz magnit-rezonans tomografiyaning vizual nazorati ostida fokuslangan ultratovush yordamida bir tomonlama talamik termal ablasiya olgan 40 nafar essentsial tremorli bemorlarni kuzatdik.

Usullari. Bemorlar tekshirildi va "essentsial tremor" tashxisi qo'yildi, ular so'rovnomada asosiy tremorning umumiy ball zo'ravonligini aniqlashdi.

Natijalar. Davolanishdan oldin va keyin bemorlarda olingan natijalarni solishtirganda, ayollarda ham, erkaklarda ham umumiy ET ballida sezilarli yaxshilanish kuzatildi. Ammo shuni ta'kidlash kerakki, chap qo'l bilan bog'liq ET parametrlari (chap qo'l tremori, chap qo'lni chizish, chap qo'l ichish) o'zgarishsiz qoldi, bu katta ehtimollik bilan bir tomonlama talamik termal ablasiya bilan bog'liq.

Xulosa. Esansiyel tremorni MRI yordamida yo'naltirilgan ultratovush yordamida davolash samarali va xavfsiz davolash usuli hisoblanadi. Biroq, bu talamik termal ablasyonning qarama-qarshi tomonidagi tremorga ta'sir qilmaydi va talamik termal ablasyon muolaga paytida bemorlarning kichik bir qismida qaytariladigan asoratlar va davolanishdan ba'zi doimiy yon ta'sirlarga ega.

Kalit so'zlar: essentsial tremor, bir tomonlama talamik termal ablasiya, fokuslangan ultratovush, magnit-rezonans tomografiya

Introduction

Essential tremor (ET) is defined as an isolated tremor syndrome with bilateral upper extremity involvement of at least 3 years duration, sometimes accompanied by tremor elsewhere (in the head, larynx (voice tremor), or lower extremities) that occurs in the absence of other neurological symptoms, such as like ataxia and parkinsonism [1, 9]. Pathology affects approximately 1% of the population worldwide [2, 6, 8]. The incidence increases with age, with most studies not revealing differences in prevalence between males and females [4, 10]. Although essential tremor is not life threatening, it can make daily tasks difficult: holding drinks, eating, writing, and drawing, playing musical instruments, and playing sports [3, 11].

Due to the high prevalence of essential tremor, the difficulties of diagnosis and the lack of a complete medical correction of the pathology, at the present stage, unilateral thalamic thermal ablation with the help of focused ultrasound under the visual control of magnetic resonance imaging (MRI) began to prove itself, which contributed to a significantly greater reduction in hand tremor and improved quality life within 12 months [7, 10].

The aim of our study was to investigate the effectiveness of unilateral thalamic thermal ablation using focused ultrasound under image-guided magnetic resonance imaging in patients with essential tremor.

Patients and Methods

Under our supervision and treatment in the department of neurology of faculty of Medicine of the University of Santiago de Compostella there were 40 patients with ET - 16 men and 24 women. The mean age of the patients was 70.4 ± 3.0 years, in men - 73.7 ± 4.3 years, in women - 69.0 ± 3.8 . After examination and diagnosis of ET, all patients underwent unilateral thalamic thermal ablation using focused ultrasound under visual control of magnetic resonance imaging (MRI). The parameters of thermal ablation were: the number of active elements - from 793 to 1010, the number of directed ultrasonic beams - from 5 to 10, the maximum energy in joules - from 9200 to 32390, the maximum temperature from 56 to 60 degrees.

Result and discussions

Upon admission to the neurological department from the anamnesis, it was revealed that the duration of the disease in patients was 27.6 ± 2.9 years, in men - 25.5 ± 4.4 years, in women - 28.4 ± 3.8 . Of these, 22 patients were constantly taking propranolol, 9 patients were taking primidone, 7 patients were taking topiramide, and 2 patients were taking clonazepam. When examining the signs of tremor in patients before treatment, it was 57.5 ± 3.0 points. Moreover, in men, the severity of ET was slightly higher than in women (Table 1). And at the same time, according to the signs of tremor among men and women, there were no significant differences. When comparing the results obtained in patients before and after treatment, a significant improvement in the total ET score was obtained in both women and men. However, it should be noted that ET parameters associated with the left hand (left hand tremor, left hand drawing, left hand drinking) remained unchanged, which is most likely associated with unilateral thalamic thermal ablation.

It should also be noted about the complications during the procedure of thalamic thermal ablation and persistent side effects from the treatment. Thus, among the complications that were observed during the thalamic thermal ablation procedure were: dizziness in 2 patients, temporary numbness of the right hand, transient parasthesia of the face and mild dysarthria in 1 patient. And among the persistent side effects that were observed in two patients were: mild dysarthria and infarction of the skull bones. In one patient, after the therapeutic measure, no effect was observed in relation to ET at all.

Treatment of tremor with MRI-guided focused ultrasound was approved by the FDA in 2016 [12]. The effectiveness of the procedure according to Marc N. Gallay (2020) was 95% after two days, 96% after 3 months and 93% after a year. The procedure has not been associated with complications such as bleeding, infection, and dysarthria [5]. Focused ultrasound is a non-invasive treatment for tremor. High-intensity ultrasound waves are applied to act exclusively on the affected area of the brain, without affecting the surrounding tissues. Ultrasonic waves pass unhindered through the bones of the skull and accurately reach the necessary area of the brain - the thalamus. Then ablation is carried out. The tremor is stopped by interrupting the flow of abnormal electrical signals. Magnetic resonance imaging is used by the surgeon to direct ultrasound waves as accurately as possible to the area of the brain that initiates abnormal electrical activity and provokes tremors.

Conclusions

Our studies allow us to conclude that the treatment of essential tremor with MRI-guided focused ultrasound is an effective and safe method of treatment. However, it does not affect the tremor on the opposite side of the thalamic thermal ablation and has reversible complications in a small proportion of patients during the thalamic thermal ablation procedure and some persistent side effects from the treatment. The identified shortcomings and side effects of the studied treatment method dictate the need to improve the methods of differentiated impact of focused ultrasound on the thalamus.

Acknowledgments

The authors are grateful to: the staff of the department of neurology of faculty of Medicine of the University of Santiago de Compostella in helping to select patients and conducting unilateral thalamic thermal ablation with magnetic resonance imaging guided focused ultrasound. The authors declare that they have no conflicts of interest when writing this article. The publication is funded from its own funds.

Tab. Signs of tremor in patients before and after treatment

| Tremor signs | male | female | all patients | male | female | all patients |
|------------------------------|------------------|----------|--------------|-----------------|-----------|--------------|
| | before treatment | | | after treatment | | |
| facial-lingual | 0±0 | 0±0 | 0±0 | 0±0 | 0±0 | 0±0 |
| voice | 0,8±0,4 | 0,6±0,2 | 0,7±0,2 | 0,5±0,3 | 0,5±0,2 | 0,5±0,2 |
| head | 1,0±0,4 | 1,1±0,3 | 1,1±0,2 | 0,7±0,3 | 0,5±0,2 | 0,6±0,2 |
| right hand | 7,0±0,6 | 6,0±0,7 | 6,3±0,5 | 1,8±1,3* | 1,0±0,2* | 1,3±0,4* |
| left hand | 7,7±1,0 | 5,1±0,4 | 5,9±0,5 | 7,8±0,9 | 5,2±0,7 | 6,0±0,6 |
| torso | 0±0 | 0±0 | 0±0 | 0±0 | 0±0 | 0±0 |
| right leg | 0±0 | 0±0 | 0±0 | 0±0 | 0±0 | 0±0 |
| left leg | 0±0 | 0±0 | 0±0 | 0±0 | 0±0 | 0±0 |
| orthostatic | 0±0 | 0±0 | 0±0 | 0±0 | 0±0 | 0±0 |
| dominant hand drawing | 12,3±1,2 | 11,8±1,1 | 12,0±0,8 | 4,2±2,5* | 2,9±0,6* | 3,3±0,8* |
| non-dominant hand drawing | 8,5±1,6 | 8,5±0,6 | 8,5±0,6 | 9,2±1,4 | 8,8±0,6 | 8,9±0,6 |
| drinking with the right hand | 3,5±0,2 | 2,6±0,4 | 2,9±0,3 | 1,2±0,6* | 0,6±0,3* | 0,8±0,3* |
| drinking with the left hand | 3,2±0,7 | 2,6±0,3 | 2,8±0,3 | 3,0±0,4 | 2,5±0,4 | 2,7±0,3 |
| talk | 0,7±0,3 | 0,7±0,3 | 0,7±0,2 | 0,3±0,2 | 0,6±0,2 | 0,6±0,2 |
| meal | 2,7±0,2 | 2,6±0,2 | 2,7±0,2 | 0,8±0,5* | 0,4±0,2* | 0,6±0,2* |
| drink | 3,2±0,2 | 2,8±0,3 | 2,9±0,2 | 0,8±0,7* | 0,5±0,3* | 0,6±0,3* |
| toilet | 2,5±0,2 | 2,4±0,2 | 2,4±0,2 | 0,7±0,5* | 0,3±0,2* | 0,4±0,2* |
| dressing | 1,8±0,3 | 1,4±0,3 | 1,6±0,2 | 0,8±0,4* | 0,4±0,2* | 0,5±0,2* |
| letter | 2,5±0,4 | 2,7±0,3 | 2,7±0,2 | 1,3±0,6* | 0,6±0,2* | 0,8±0,2* |
| Job | 2,5±0,3 | 2,2±0,3 | 2,3±0,2 | 0,5±0,3* | 0,5±0,2* | 0,5±0,2* |
| social | 2,2±0,3 | 2,1±0,3 | 2,2±0,3 | 0,8±0,5* | 0,3±0,1* | 0,5±0,2* |
| processed side | 22,8±1,5 | 20,9±1,8 | 21,5±1,3 | 7,2±4,3* | 4,4±0,9* | 5,3±1,4* |
| functional | 18,0±1,2 | 17,5±1,4 | 17,6±1,0 | 6,3±3,2* | 3,6±1,1* | 4,4±1,2* |
| Total score | 62,5±4,8 | 55,3±3,8 | 57,5±3,0 | 34,5±9,7* | 25,6±3,0* | 28,3±3,5* |

Note: * $p < 0.05$ before and after treatment

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