

## Microsurgical denervation at focal muscular dystonia, in torticollis patients

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### Abstract

**Background:** Surgical treatment of focal muscular dystonia, despite all achievements of modern neurosurgery, and auxiliary methods of diagnostics, continues to cause more questions, than gives answers. The main challenge for all who uses denervation techniques in treatment of spastic wryneck (SW) is accurate identification and the fullest exclusion of the dystonic muscles which take part in the formation of complex of symptoms of SW.

**Material and methods:** 32 patients with torticollis were enrolled into the study. All enrolled patients underwent 75 microsurgical denervations of dystonic muscles, including 32 selective denervations of contralateral sternocleidomastoid muscle, 28 selective posterior ramisection of C1-C6 roots (Bertrand's procedure), 15 denervations and myotomias of dystonic muscles of omo-trapezoid triangle (DMOTT).

**Results:** The outcome evaluation was conducted via neurological examination and Toronto Western Spasmodic Torticollis Rating Scale (TWSTRS) questionnaire. The outcomes showed decrease of severe torticollis (up to 0%), severe disability decreased to 0%, light disability increased from 0% to 60.71%. DMOTT strongly affected, thus improved, the outcomes.

**Conclusions:** Initial indicators of weight of a current of SW with torticollis decreased to zero that once again emphasize efficiency and adequacy of the interventions chosen the denervation and surgical targets. Easy severity prevailed at all patients in the remote terms of supervision – 60.71% that managed to be reached performance of DMOTT. Thus, the carried-out microsurgical interventions, in particular DMOTT, allowed us to reach positive result (in the context of decrease in weight of a course of a disease) at 100% of patients with T.

**Key words:** muscular cervical dystonia, spastic wryneck, torticollis, microsurgical denervation.

### Introduction

According to Sitthinamsuwan B. et al. [8] the resection of peripheral nerves has to be the main, primary method of surgical treatment of uncomplicated cases of the spastic torticollis (ST).

Spastic wryneck (SW) – a focal form of muscular dystonia (D) which is shown by the tonic, clonic or tonico-clonic spasms of muscles of a neck which lead to temporary or continuous compelled position of the head and neck.

Prevalence of focal forms of muscular dystonia by results of the conducted researches in the countries of the European

Commonwealth makes up from 5,7 to 29,5 cases per 100 thousand population [2,6,1]. SW belongs to the most widespread forms of focal dystonias. According to Kandel E. I. [3] idiopathic SW makes up to 63% of all cases of SW. On average from 8 to 10 new cases of SW per 100 thousand populations are registered yearly. [4].

Conservative therapy of SW is directed first of all at the restoration of neurotransmitter balance in subcortical structures of a brain. Therapy by botulinum toxin – a hemodenervation of muscles which take part in the formation of complex of symptoms of SW – is effective in 70-85% of cases, despite quite unstable and, sometimes, quite short-term effect [5, 9].

Surgical treatment of focal muscular dystonia, despite all achievements of modern neurosurgery, and auxiliary methods of diagnostics, continues to cause more questions, than gives answers. The main challenge for all who uses denervation techniques in treatment of SW, is accurate identification and the fullest exclusion of the dystonic muscles which take part in the formation of complex of symptoms of SW. It is considered that exactly those surgeons who take into account all variety of features of an innervation of back group of muscles of a neck and their role in realization of turn of the head, achieve the best results [7].

The main approaches and the list of denervation procedures are known for a long time: the purpose is formulated, targets are defined, and surgical interventions are developed and introduced in practice [7]. The extensive experience of treatment of patients with the SW various forms is saved up, the list of complications was considerably decreased. Despite all aforesaid, results still remain far from an ideal: there is a high risk of the residual phenomena and, sometimes, even recurrence of a disease [9, 7]. Having analyzed own accumulated experience, we developed essentially new approach to staging (sequence) of surgical interventions and expanded not only the range of targeted muscles, but also significantly improved a denervation technique. Such approach to treatment of SW allowed us to improve significantly results of microsurgical denervation at patients with torticollis (T).

### Material and methods

The study is based on the analysis of surgical treatment of 32 patients with torticollis who stayed for treatment in restorative neurosurgery department of A. P. Romodanov State Institute of Neurosurgery (Kiev, Ukraine) from 2002 to 2014.

The total of patients with torticollis that took part in research made up 32 patients. Age groups of patients looked as follows: patients of young age (21-44 years) – 0, average (45-59 years) – 24 (75%), and advanced age (60-74 years) – 8 (25%). Prevalent the male patients: 24 men (75%) and 8 women (25%). According to the duration of the existing disease patients were distributed as follows: 9 (28.1%) patients – more than 5 years, 21 (65.6%) – from 5 to 2 years, 2 (6,25%) – less than 2 years suffered from T. To 14 patients (43.75%) with T at a pre-hospital stage therapy botulinum toxin with insignificant and/or temporary effect was prescribed. Easy initial severity of SW by Toronto Western Spasmodic Torticollis Rating Scale

I (TWSTRS (I)) we observed at 2 (6.25%) patients, moderate severity – at 22 (68.75%) and extreme severity – at 8 (25%). 26 patients (81.25%) at the time of inclusion in research considered themselves people with hard T invalidization, 6 (18.75%) – with the average level of an invalidization (by TWSTRS (II)).

To patients with T 75 surgical interventions of denervation of spasmodic muscles were executed. Out of them 32 (42.66%) – denervation contralateral (in relation to turn of the head) a sternocleidomastoid muscle, 28 (37.33%) – an ipsilateral back cervical ramisection of C1-C6 of backs (BCR) and 15 (20%) – contralateral denervation of muscles of omo-trapezoid triangle (DMOTT).

DMOTT – implies a denervation and a myotomy of a muscle which raises a corner of a shovel (LS) and m. splenius capitis (MSC). Forward branches of C3-C4, derivatives of a cervical texture were the main sources of an innervation of the muscles stated above. DMOTT was developed in our clinic, and its efficiency is confirmed with results of the conducted research.

Collecting primary results of surgical treatment began not earlier than in 14 days (early results) after the termination of all planned stages of a surgical denervation that corresponded to the moment of the patient's leaving the hospital, and included an assessment of clinical and neurological data, questioning on TWSTRS. When collecting late results (till 1 year after carrying out the denervation interventions) and remote results (2 years after carrying out the denervation interventions) we performed careful clinical and neurological examination and questioning on TWSTRS. Moreover, clinical and neurological inspection and collecting of biographical particulars were carried out at any moment of the patient's addressing the clinic. The maximum term of supervision over the patient after performance of all stages of denervation of microsurgical interventions made up 11 years, on average 5 years  $\pm$  2 months.

Questioning provided determination of the severity of SW (TWSTRS (I)) and invalidization level (TWSTRS (II)) – collecting the early, late and remote results of microsurgical denervation interventions.

Assessment of the severity of SW by (TWSTRS (I)) envisaged questioning of the patient and assessment by himself his own state on the basis of 6 indicators: the maximum excursion of the head and neck in 3 main planes; duration of pathological installation/tension of muscles for 24 hours; existence or absence of trigger points which are capable to facilitate the patient's condition; shoulder elevation degree, active volume of movements; time throughout which the patient is able to hold a head/neck in neutral situation. The score of indicators defined severity of SW: 0-10 points – easy severity, 11-25 points – average, 26-35 points – heavy degree of SW.

Assessment of the level of an invalidization of the patient (TWSTRS (II)) implied an assessment by himself of own state by score system – activity in 6 typical environments: work, daily activity, and reading, driving, and watching of the TV, activity outdoors. The score of indicators determined invalidization level: 0-10 points – easy invalidization, 11-20 points – average level, 21-30 points – heavy invalidization.

Statistical data processing, received as a result of the conducted research, was carried out as follows: criterion  $\chi^2$  Pearson was determined for the purpose of detection of a link between factorial and productive signs. So, terms during which the analysis of results was carried out (before and after carrying out interventions of microsurgical denervation) were factorial signs in our research. Productive – 3 degrees/levels of the severity of invalidization while the assessment of the early, late and remote results.

All statistical calculations were made by means of the Excel program from the software package of "Microsoft Office 2003".

### Results and discussion

All denervation interventions at patients with T were followed by 2 main types of complications: a dysesthesia in a dermatome which autonomous innervation is provided by C2 spinal nerve; infectious complications from an operational wound.

The total complications accounted for 26 cases: among them the dysesthesia in a zone of an innervation of C2 of a spinal nerve after carrying out BCR – 24 considerably prevailed (92.3%). Infectious complications in the postoperative period were observed at 2 patients (7.69%).

In the analysis of early results (till 14 days), we observed at 12 patients (37.5%) with T clinical and neurological regress of SW symptomatology: the tone of dystonic muscles which had been denervated was absent, position of the head and neck was approaching the physiological one. At 7 patients (21.87%) the clinical and neurological picture was followed by the expressed pains in postoperative wounds (in particular after BCR) that considerably complicated the assessment of regress of SW symptomatology – patients tried to keep compelled postures. The number of T patients who in the analysis of early results considered that degree of a course of their disease decreased, made up 2 (6.25%) patients. It should be noted that 4 T patients (12.5%) with initial average severity of SW refused to undergo further stages of surgical denervation, considering that their state considerably improved after a denervation of a contralateral sternocleidomastoid muscle.

In the analysis of late results at 15 T patients we noted only insignificant regress of clinical and neurological symptomatology of SW: the tone of ipsilateral denervated dystonic back cervical and paravertebral muscles (BCPVM) was raised, rotation of the head and neck in the direction of muscles with the raised tone, an elevation of a shovel and shoulder was observed. EMG investigation revealed pathological dystonic activity of ipsilateral LS and, in general, muscles of omo-trapezoid triangle of a neck. We suggested carrying out DMOTT to all 15 patients for the decrease in the tone of the dystonic muscles of omo-trapezoid triangle – all patients agreed to undergo denervation surgery.

At 12 patients (50%) at the time of discharging from the hospital the dysesthesia in C2 innervation zone was observed, but we didn't observe full regress of sensitive deficiency. At 3 patients (12.5%) out of 24 who at the time of discharging still had the dysesthesia in C2 innervation zone, we observed

considerable, though partial regress of sensitive deficiency. At 5 patients (45.83%) the dysesthesia considerably worsened the quality of life and it significantly reflected in indicators an invalidization. The number of patients who in the analysis of late results considered that the severity of the course of their disease decreased, made up 1 patient. It should be noted that in the analysis of late results, we didn't observe a clear tendency to the reduction of the severity of the disease course at patients with T. The analysis of late results on the basis of data of questioning patients with T allowed to determine the following changes in invalidization levels. 6 patients with the initial grave level of invalidization moved to group with the average level of invalidization. It is necessary to emphasize that we observed an accurate tendency of decrease in the level of invalidization at patients with T in dynamics: so, the initial grave level of invalidization was observed at 81.25% of patients, in the analysis of late results – at 71.48%. In the analysis of late results, the average level of invalidization made up already 28.57% at initial indicators of 18.75%.

In the analysis of the remote results at 15 T patients (all those who underwent DMOTT) we noted essential regress of clinical and neurological symptomatology of SW: the tone of denervated muscles was absent, position of the head and neck came nearer to the physiological. EMG investigation didn't find pathological dystonic activity of denervated muscles. At all 12 (50%) patients at the time of discharging from clinic was observed dysesthesia in C2 innervation zone, though we didn't observe full regress of sensitive deficiency. At 3 patients (12.5%) out of 24 at the time of discharging the dysesthesia in C2 innervation zone remained, and we observed considerable, but, nevertheless, partial regress of sensitive deficiency. At 5 patients (45.83%) the dysesthesia considerably worsened the quality of life that was reflected in invalidization indicators. The number of patients, who in the analysis of the remote results considered that severity of their disease decreased, made up 17 patients. So, 7 patients with an initial grave course of SW moved to the group of patients with an easy course of SW. 10 patients with moderate severity of SW course moved to the group of patients with an easy course of SW. It is necessary to emphasize that namely 15 patients with T for whom DMOTT was carried out, constituted the largest group that had the course of SW considerably decreased: 7 patients with initially heavy and 8 with moderate severity of SW course. Thus, we observed a precise tendency of decrease in severity of a disease at patients with T in dynamics: so, initial heavy degree was observed at 25% of patients, average – at 68.75%, and in the analysis of the remote results of heavy degree of SW course wasn't observed – 100% decrease in the indicator. Moderate severity accounted for already 39.28%, the light course was observed at 60.71% – the group increased by 17 patients (fig. 1.). In the analysis of the remote results, we found close statistical connection between the change of gravity of the course of the disease and the carried-out surgical interventions ( $\chi^2=21,465$ ;  $\chi^2_{critical}=9,21$ ;  $p < 0,01$ ). In other words, in the analysis of the remote results we found statistically considerable influence of the carried out surgical denervation interventions on the reduction of severity of the disease in patients with T.

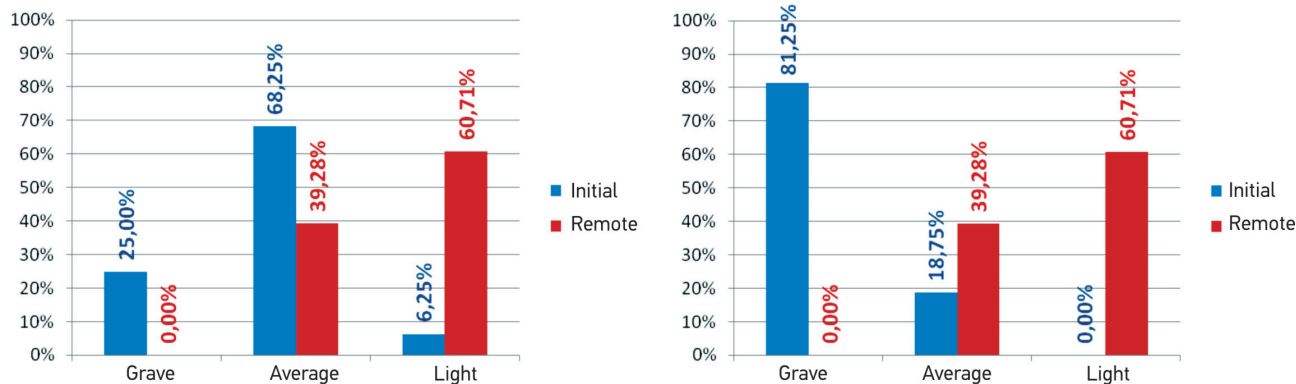


Fig. 1. Dynamics of change of severity of the course and levels of invalidization at patients with torticollis.

It is necessary to emphasize that we found statistically significant connection between the gravity of a course of a disease and the late and remote results ( $\chi^2=27,125$ ;  $\chi^2_{critical}=9,21$ ;  $p < 0,01$ ). It means that we observed statistically reliable reduction of disease severity in the remote terms of follow-up in comparison with late terms of it. In a time interval between the follow-up terms stated above, 15 patients underwent DMOTT that allowed reducing statistically authentically the severity of SW course with T. Relative indicators prove that carrying out DMOTT allowed reducing the gravity of the course of the disease at 100% of patients. The analysis of the remote results allowed us to determine the following changes in invalidization levels at patients with T: 16 patients with the initial grave level of invalidization moved to the group of patients with the light level of invalidization. 4 patients with the initial grave level of invalidization moved to the group of patients with the average level of invalidization. 1 patient with the initial average level of invalidization moved to the group of patients with the light level of invalidization. All 15 patients to whom DMOTT was carried out, were included into the group of patients whose initial heavy level of invalidization changed for the light one. We observed a distinct tendency of decrease in the level of invalidization at patients with T in dynamics: initial grave level of invalidization was observed at 81.25%, in the analysis of the remote results – the grave level of invalidization after all carried-out stages the denervation interventions were not realized any more. We didn't observe the initial light level of invalidization among patients; in the analysis of the remote results it made up 60.71% that meant more than by 60 times exceeded initial indicators. In the analysis of the remote results, we found close statistical connection between levels of invalidization and the carried-out surgical interventions ( $\chi^2=44,401$ ;  $\chi^2_{critical}=9,21$ ;  $p < 0,05$ ). In other words, we found statistically significant influence of the denervation interventions on the decrease in the level of invalidization in patients with T. Also we found statistically significant link between invalidization levels, the late and remote results of surgical treatment of T ( $\chi^2=37,474$ ;  $\chi^2_{critical}=9,21$ ;  $p < 0,01$ ). It means that statistically reliable decrease in the level

of invalidization in the remote terms in comparison with late terms of follow-up was observed – DMOTT to 15 patients was carried out at the time interval stated above.

### Conclusions

Initial indicators of gravity of SW course with T decreased to zero; this once again emphasizes the efficiency and adequacy of the chosen denervation interventions and surgical targets. Light severity prevailed at all patients in the remote terms of the follow-up – 60.71% that was managed to be achieved by the performance of DMOTT. Thus, the carried-out microsurgical interventions, in particular DMOTT, allowed us to get positive results (in the context of the decrease in the severity of the course of the disease) at 100% of patients with T.

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