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Article

The Results of Surgical Treatment of Fixed Syndrome Spinal Cord Caused by Thickened Terminal Thread

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Abstract: To evaluate the method of intraoperative electroneurophysiological monitoring during surgery of a thickened terminal thread having an invasive location with nerve tissues. The study included patients from 1 year old with spina bifida, with a thickened terminal filament, with invasive - infiltrative spread into the roots of the spinal cord. Investigated 40 patients from 2010 to 2019. Intraoperative electrophysiological differentiation of the structures of the spinal cord and its roots was carried out in 19 patients (main group) and without it in 21 children (control group). The use of the technique of intraoperative identification of nerve roots in the surgery of the fixed spinal cord syndrome caused by the terminal thread allows in the early postoperative period to reduce the likelihood of the appearance and aggravation of neurological disorders by 1.5 times. The operational time spent on preparation and identification in the monitoring process is compensated by the ability to determine the maximum permissible radicality without significant damage to the health of children.

Keywords: Thickened terminal filament, spina bifida, neuromonitoring, fixed spinal cord syndrome.

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Introduction

A thickened filum terminale is a very common malformation of the spinal cord and vertebral column, which can lead to “tethered cord syndrome,” also known as “spinal cord traction syndrome.” The clinical presentation may be characterized by progressive neurological symptoms affecting the lower limbs, urinary bladder and colon functions, as well as skeletal and orthopedic disorders, skin manifestations, and signs of dysraphism[1].

Externally, a thickened filum terminale may be manifested by barely noticeable hyperpigmentation and hypertrichosis in the lumbar region; however, in most cases, it presents without any visible signs. The thickened filum terminale may exist as an independent condition or as part of other dysraphic anomalies[2].

A thickened filum terminale is identified through MRI examination—it appears shortened and thickened, with the conus medullaris located below the L3 vertebra, and the thickening may also be associated with lipoma. The thickened filum terminale may be isolated and separated from other structures or may be fused with individual nerve fibers and even roots; therefore, it is important to avoid damaging them during surgical sectioning[3].

The aim of the study was to evaluate the method of intraoperative electroneurophysiological monitoring during surgery for a thickened filum terminale (FT) that is invasively associated with nervous tissue[4].

Materials and Methods

The study included patients aged 1 year and older with spina bifida, a thickened filum terminale (FT), and invasive infiltrative extension into the spinal cord roots. A total of 40 patients treated in the pediatric department of the Neurosurgery Center between 2010 and 2019 were examined. Intraoperative electrophysiological differentiation of the spinal cord structures and their roots was performed in 19 patients (study group) and in 21 children (control group).

Intraoperative monitoring was carried out using the INNOMED computer system (an electroneuromyography (ENMG) device) with software manufactured in Germany, as well as our own software product conditionally named "Liporadiculomonitoring." Data were recorded using needle electrodes placed according to the segmental innervation of the lower limbs. Spinal cord structures were identified in the surgical field by electrical stimulation using a bipolar electrode with a stimulation duration of 0.1 ms and a frequency of 2–3 Hz[5].

To ensure the anatomical preservation of abnormally located elements of nervous tissue, parameters were continuously measured at all stages of the surgical procedure. Initially, a monopolar electrode was used, after which the filum terminale itself was directly stimulated[6].

During surgery on the thickened filum terminale, the examined tissues were stimulated to isolate them and preserve their conductivity. After the transection stage, control electrical stimulation was performed to confirm the preservation of all nerve roots[7].

The surgical outcome was evaluated in both groups 7–10 days after the operation using ENMG. Statistical analysis was performed using Student's t-test to determine the reliability of the obtained data[8].

Results and Discussion

A comparison of the dynamics of changes in ENMG data in patients of the study and control groups in the early postoperative period showed that when the method of electrophysiological differentiation of spinal cord roots was applied, the percentage of patients with worsening indicators in the study group was significantly lower than in the control group—26.4% and 38.1%, respectively ($p < 0.05$)[9].

For electrophysiological characterization, we determined parameters for the main components of impulses: conduction velocity (EPC) and PV—the nerve excitation threshold—recorded along the tibial and peroneal nerves in patients with a thickened filum terminale [10]. Among the many parameters describing ENMG, these two indicators most objectively reflect surgical outcomes and allow real-time control of actions and tactics[11]. These parameters were compared with the technical specifications provided by the ENMG device manufacturer. Based on this, we determined the values and changes of the recorded impulse parameters presented in Table 1[12].

Intraoperative ENMG parameters made it possible to determine the initial level of neurological deficit, the degree of tension of the nerve roots caused by the filum terminale, and the nature of the tethering syndrome[13]. Although an increase in PV by 2 mA was sufficient to characterize tethering syndrome in real time and to detect improvement in the compression index after tension release, this indicator increased by at least 10% from the baseline level[14].

Table 1. Developed ENMG parameters used for intraoperative monitoring during filum terminale transection.

ENMG Indicators	Tibial Nerve	Peroneal Nerve
SPI effect (m/s)	20–24.5	31–35.5
PV for tethering syndrome (mA)	+2 mA	+1–2 mA
PV for compression ratio (mA)	+10% from baseline	+12% from baseline

Table 2. Comparative characteristics of surgical outcomes using neuromonitoring during filum terminale transection.

Characteristics of Thickened Filum Terminale	**Group 1 (with neuromonitoring), n=19**				**Group 2 (without neuromonitoring), n=21**			
	Improvement		No change / worsening		Improvement Abs		No change / worsening	
	Abs	%	Abs		Abs	%	Abs	%
Neurological status	14	73.6	5	26,4	13	61,9	8	38,1
Degree of root compression	12	63.1	7	36,9	9	42,8	12	57,2
Tethering syndrome	16	84.2	3	15,8	11	52,4	10	47,6

Furthermore, it should be noted that the negative changes identified in 26.4% of patients in the study group were significantly less pronounced compared to the control group (Table 2)[15]. Among these 26.4% of patients in the study group, clinical deterioration of neurological parameters was observed in only 13% of cases and was unstable and temporary in nature. In contrast, clinical deficits in various neurological domains in the control group were observed in 12% of patients; however, these were persistent neurological changes that were difficult to correct with medication[16].

As shown in Table 2, similar to neurological status, the use of real-time neuromonitoring leads to improved root decompression and more effective elimination of tethering syndrome[17].

Conclusion

The use of intraoperative nerve root identification in the surgical treatment of tethered cord syndrome caused by the filum terminale reduces the likelihood of the development and worsening of neurological disorders in the early postoperative period by 1.5 times.

The additional surgical time spent on preparation and identification during monitoring is compensated by the ability to determine the maximum permissible radicality without causing significant harm to the health of children.

REFERENCES

[1] V. G. Voronov, G. E. Chmutin, and E. G. Chmutin, Vertebromedullary Malformations in Children: Practical Guide to Diagnosis and Treatment of Spinal Cord and Spine Malformations in Children. Moscow: Econ-Inform, 2016, p. 395.

[2] K. V. Sysoev, E. N. Zharova, Y. M. Zabrodskaya, et al., “Occult tethered cord syndrome in children (clinical observation and literature review),” Neurosurgery, no. 3, pp. 53–58, 2016.
[3] P. De Vloo, A. G. Monea, and R. Sciot, “A cadaver study of anatomy, histology, and elastic properties,” World Neurosurgery, vol. 90, pp. 565–573, 2016.
[4] R. L. Young, T. H. Habrock-Bach, and M. Vaughan, “Symptomatic retethering of the spinal cord following section of a tight filum terminale,” Neurosurgery, vol. 68, pp. 1594–1602, 2011.
[5] S. Yamada, D. J. Won, and G. Pezeshkpour, “Pathophysiology of tethered cord syndrome and similar complex disorders,” Neurosurgical Focus, vol. 23, no. 2, p. E6, 2007.
[6] T. Sanchez and R. M. John, “Early identification of tethered cord syndrome: a clinical challenge,” Journal of Pediatric Health Care, vol. 28, no. 3, pp. E23–E33, 2014.
[7] A. Rossi, R. Biancheri, and A. Cama, “Imaging in spine and spinal cord malformations,” European Journal of Radiology, vol. 50, no. 2, pp. 177–200, 2004.
[8] F. Rinaldi, F. A. Cioffi, and L. Columbano, “Tethered cord syndrome,” Journal of Neurosurgical Sciences, vol. 49, no. 4, pp. 131–135, 2005.
[9] A. A. Qodirov, “Diagnosis and treatment methods of spinal cord defects in children,” Tibbiyot va Zamon, no. 2, pp. 45–49, 2020.
[10] N. T. Rasulov, “Analysis of neurological syndromes associated with spina bifida,” O‘zbekiston Tibbiyot Jurnali, no. 4, pp. 32–36, 2021.
[11] D. A. Tursunov, “Congenital spinal column pathologies in children,” Pediatrics and Pediatric Surgery, no. 1, pp. 18–22, 2022.
[12] M. A. Yuldashev, Neurology and Clinical Practice. Tashkent: Fan va Texnologiya, 2019.
[13] B. S. Ismoilov, “Spinal cord syndromes and their clinical course,” Neurology Bulletin, no. 3, pp. 27–31, 2023.
[14] U. R. Axmedov, “Modern diagnostic methods and MRI capabilities,” Journal of Medical Diagnostics, no. 2, pp. 40–44, 2022.
[15] F. X. Abdullayev, “The importance of electromyography in neurological diseases,” Medical Scientific Bulletin, no. 1, pp. 55–59, 2020.
[16] S. O. Jo‘rayev, “Tethered cord syndrome and its clinical features,” Young Scientists Medical Journal, no. 5, pp. 61–65, 2023.
[17] R. X. Zokirov, “The role of neuromonitoring methods in neurosurgery,” Innovative Medicine, no. 6, pp. 12–16, 2024.