นิพนธ์ต้นฉบับ

ความชุกและปัจจัยที่มีความสัมพันธ์ต่อการตรวจพบความผิดปกติจากการตรวจไฟฟ้าวินิจฉัยในกลุ่มผู้ป่วยเด็กที่สงสัยว่ามีภาวะเส้นประสาทผิดปกติหลายเส้น: การศึกษาแบบย้อนหลัง ณ ช่วงเวลาใดเวลาหนึ่ง

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Received September 17, 2024 Revised December 1, 2024 Accepted December 20, 2024

บทคัดย่อ

ความเป็นมา: การตรวจไฟฟ้าวินิจฉัย เป็นเครื่องมือที่มีความสำคัญในการวินิจฉัยโรคทางระบบประสาทและกล้ามเนื้อในผู้ป่วยเด็กมาเป็นเวลายาวนาน แต่อย่างไรก็ตามยังไม่มีงานวิจัยที่ศึกษาความชุกและปัจจัยที่มีความสัมพันธ์ต่อการตรวจพบความผิดปกติจากการตรวจไฟฟ้าวินิจฉัย ในกลุ่มผู้ป่วยเด็กที่สงสัยว่ามีภาวะเส้นประสาทผิดปกติหลายเส้น

วัตถุประสงค์: เพื่อศึกษาความชุกและปัจจัยที่มีความสัมพันธ์ต่อการตรวจพบความผิดปกติจากการตรวจไฟฟ้าวินิจฉัย ในกลุ่มผู้ป่วยเด็กที่สงสัยว่ามีภาวะเส้นประสาทผิดปกติหลายเส้น

วิธีการศึกษา: งานวิจัยนี้เป็นการเก็บรวบรวมข้อมูลย้อนหลังจากเวชระเบียนผู้ป่วยในสถาบันสุขภาพเด็กแห่งชาติมหาราชินี โดยประกอบไปด้วยข้อมูลทั่วไป และข้อมูลที่ได้จากผลการตรวจไฟฟ้าวินิจฉัย นำข้อมูลไปวิเคราะห์ด้วยโปรแกรมทางสถิติ

ผลการศึกษา: จากกลุ่มตัวอย่างทั้งหมด 48 คน มี 29 คน พบภาวะเส้นประสาทผิดปกติหลายเส้น จากการตรวจไฟฟ้าวินิจฉัย ความชุกร้อยละ 60.4 (95%CI: 45.3, 74.2) ไม่พบความแตกต่างอย่างมีนัยสำคัญทางสถิติของอายุ เพศ น้ำหนัก ส่วนสูง ระยะเวลาที่มีอาการ และประวัติคลอด และการตรวจพบความผิดปกติทางไฟฟ้า ระหว่าง 2 กลุ่ม โดยเส้นประสาทสั่งการที่ตรวจพบความผิดปกติมากที่สุด คือเส้นประสาท peroneal (38 เส้นจาก 47 เส้น คิดเป็นร้อยละ 80.9) และเส้นประสาทรับความรู้สึกที่ตรวจพบความผิดปกติมากที่สุด คือเส้นประสาท sural (29 เส้นจาก 32 เส้น คิดเป็นร้อยละ 90.6)

สรุป: ความชุกของการตรวจพบความผิดปกติทางไฟฟ้าเท่ากับร้อยละ 60.4 ไม่พบความแตกต่างอย่างมีนัยสำคัญทางสถิติของปัจจัยที่ศึกษาและการตรวจพบความผิดปกติทางไฟฟ้าระหว่าง 2 กลุ่ม โดยเส้นประสาทสั่งการและเส้นประสาทรับความรู้สึกที่ตรวจพบความผิดปกติมากที่สุด คือเส้นประสาท peroneal และ เส้นประสาท sural ตามลำดับ

คำสำคัญ: การตรวจไฟฟ้าวินิจฉัย, เด็ก, ภาวะเส้นประสาทผิดปกติหลายเส้น

Prevalence and associated factors of nerve conduction study abnormality in children with suspected polyneuropathy diseases: A retrospective cross-sectional study

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Abstract

Background: Electrodiagnosis (EDX) testing plays an important role in the diagnosis of neuromuscular disorders in childhood. However, no previous studies have investigated the prevalence and associated factors of the Nerve Conduction Study (NCS) abnormality in children with suspected polyneuropathy diseases.

Objectives: To determine the prevalence and associated factors of NCS abnormality in children with suspected polyneuropathy diseases.

Methods: Our study used medical records from patients within Queen Sirikit National Institute of Child Health (QSNICH). Data collection included demographic data and the characteristic features of NCS results. The data was then analyzed using a statistical calculation program.

Results: Of the 48 participants analyzed, 29 were diagnosed with polyneuropathy based on the EDX findings. The prevalence of abnormal findings of NCS was 60.4 % (95%CI: 45.3, 74.2). There were no significant differences in age, sex, weight, height, duration of signs or symptoms, and birth history between the two groups. The most affected motor nerve were the peroneal nerves (38 nerves from a total of 47 nerves, equating to an abnormal rate of 80.9%) and the most affected sensory nerve were the sural nerves (29 nerves from a total of 32 nerves, equating to an abnormal rate of 90.6%).

Conclusion: The prevalence of abnormal findings in NCS of children with suspected polyneuropathy was 60.4 %. There were no significant differences in variables between the two groups. The most affected motor and sensory nerves in children with suspected polyneuropathy were peroneal nerve and sural nerve respectively.

Keyword: electrodiagnosis, polyneuropathy, pediatric

Introduction

Electrodiagnosis (EDX) testing plays an important role in the diagnosis of neuromuscular disorders in childhood, despite ongoing advances in genetic testing.[1,2] The previous studies found that polyneuropathy is the most common condition leading to referrals for EDX tests, followed by mononeuropathy and nonspecific or specific multiple limb complaints, respectively.[1,3] EDX is advantageous for diagnosing neuromuscular emergencies such as Guillain–Barre syndrome,[4] chronic diseases such as Charcot-Marie-Tooth disease, and chronic inflammatory demyelinating polyradiculopathy.[5,8]

However, conducting the Nerve Conduction Study (NCS) and the needle electromyography (EMG) in children, especially under two years of age, can be technically challenging.[9,10] Pediatric patients often do not understand the purpose and process of the study and therefore may not tolerate tests well, often leading to withdrawal from tests.[11] Therefore, adaptations of equipment used, methods applied, and experience of the practitioner are useful to obtain and interpret the results.[9]

The previous study conducted by Abuelwafaa N[12] reported that among children having type 1 diabetes mellitus, percentages of conduction abnormalities were 73-84% for the common peroneal nerves, 61-75% for the posterior tibial nerves, and 20-23% for the sural nerves. However, no previous studies have investigated the common characteristic features of nerve conduction studies and factors associated with abnormal NCS findings among pediatric patients suspected of having polyneuropathy.

Therefore, this study aimed to determine the prevalence and associated factors of NCS abnormality in children with suspected polyneuropathy diseases and to identify the nerves most frequently affected, which could be helpful in choosing the appropriate nerves to examine. Additionally, the association between some demographic data and NCS findings was evaluated.

Objectives

To determine the prevalence and associated factors of NCS abnormality in children with suspected polyneuropathy diseases.

Methods

Study Design and participants

The present research was a retrospective cross-sectional study conducted in the Department of Rehabilitation Medicine at the Queen Sirikit National Institute of Child Health (QSNICH), Thailand. The eligibility criteria included children (less than or equal to 15 years old) having signs or symptoms of

polyneuropathy and were referred for EDX study. However, children who had a history of peripheral nerve injury or mononeuropathy were excluded from the study. Before data collection, participants and their legal guardian were informed of the purpose and methods of the study and provided their written consent to participate in the study. The study protocol was approved by the Institutional Review Board of QSNICH (IRB 116/2565).

Data collection

The medical records of participants were reviewed. Data collection included: (1) basic demographic data including age, sex, weight, height, duration of signs or symptoms, andbirth history, (2) the characteristic features of NCS results. Motor NCS was performed for the following nerves (and recording sites): ulnar (abductor digiti minimi); median (abductor pollicis brevis); peroneal (extensor digitorum brevis); tibial (abductor hallucis) and F-wave of tibial nerve. Sensory NCS was conducted for the following nerves (with method and recording sites): median (antidromic: digit III); ulnar (antidromic: digit V); sural (antidromic: ankle). The reference values for interpreting pediatric NCS results were based on the study of Conor S. Ryan.[13] Polyneuropathy was diagnosed if any abnormal parameter of NCS was presented in any of the three extremities.

Statistical analyses

Descriptive statistics were presented as means ± SD for continuous data and percentage for categorical data. A Chi-square or Fisher exact test was used to *determine whether there is an association between demographic data of participants (*age, sex, weight, height, duration of signs or symptoms, and birth history) and the NCS results. Statistical significance was considered if a p value < 0.05

Results

A total of 48 participants were recruited for this study, including 27 males and 21 females, with a mean age of 7.7 ± 4.2 years. The participants had a mean weight of 28.31±2.61 kilograms, and a mean height of 121.93±3.84 centimeters. There were 6 (12.5%) participants with a history of preterm Over half of them (64.6%) had signs or symptoms of polyneuropathy for more than a month as shown in Table1

Table 1 Baseline characteristics.

	N=48
Sex, male[1]	27 (56.3)
Age (years)[2]	7.7 (4.2)
Body weight (kilograms)[2]	28.3 (2.6)
Height (centimeters)[2]	121.9 (3.8)
Time of onset > 1 month[1]	31 (64.6)
History of preterm[1]	6 (12.5)

[1]N (%),[2]Mean (SD)

Of 48 participants, 29 (60.4%, 95% CI: 45.3% to 74.2%) were found to have abnormal NCS results, compatible with polyneuropathy. There were no significant differences in age, sex, weight, height, duration of signs or symptoms, and birth history between the two groups, as shown in Table 2.

Table 2 Association factors between the two groups.

	No polyneuropathy (n = 19)	Polyneuropathy (n = 29)	p value
Female	9 (47.4%)	12 (41.4%)	0.7
Age > 5 years old	16 (84.2%)	18 (62.1%)	0.1
Preterm	2 (10.5%)	4 (13.8%)	1.0
Height > 110 cm.	13 (68.4%)	17 (58.6%)	0.5
Time since onset > 1 month	12 (63.2%)	19 (65.5%)	0.9

N (%)

Among 29 participants with NCS findings of polyneuropathy, the most common pattern of nerve involvement was sensorimotor nerve involvement (58.6%), followed by pure motor nerve involvement (37.9%), while only one (3.4%) showed pure sensory nerve involvement.

In terms of the frequency of the affected nerve, among 28 participants with motor involvement, the most affected nerve was the peroneal nerve (38 nerves from a total of 47 nerves, 80.9%), followed by the ulnar nerve (11 nerves from a total of 14 nerves, 78.5%), tibial nerve (42 nerves from a total of 54 nerves, 77.8%), and the median nerve (19 nerves from a total of 29 nerves, 65.5%) as shown in Table 3.

Table 3 The frequency of the affected motor nerve in 28 participants with motor involvement.

Nerve	Abnormal NCS parameters N (%)		
	Right	**Left**	**Overall (Left & Right)**
Median	11/17 (64.7)	8/12 (66.7)	19/29 (65.5)
Ulnar	8/11 (72.7)	3/3 (100)	11/14 (78.5)
Tibial	20/27 (74.1)	22/27 (81.5)	42/54 (77.8)
Peroneal	19/24 (79.2)	19/23 (82.6)	38/47 (80.9)

N (%)

Among 18 participants with sensory involvement, the most affected nerve was the sural nerve (29 nerves from a total of 32 nerves, 90.6%), followed by the ulnar nerve (6 nerves from a total of 7 nerves, 85.7%), and the median nerve (10 nerves from a total of 15 nerves, 66.7%) as shown in Table 4.

Table 4 The frequency of the affected sensory nerve in 18 participants with sensory involvement.

Nerve	Abnormal NCS parameters N (%)		
	Right	**Left**	**Overall (Left & Right)**
Median	7/10 (70)	3/5 (60)	10/15 (66.7)
Ulnar	5/6 (83.3)	1/1 (100)	6/7 (85.7)
Sural	14/16 (87.5)	15/16 (93.8)	29/32 (90.6)

N (%)

Discussion

The objectives of this study were to determine the prevalence and associated factors of NCS abnormality in children with suspected polyneuropathy disease. This study found that the prevalence of abnormal NCS findings in children with suspected polyneuropathy was 60.4%; the most common type of polyneuropathy was sensorimotor impairments; the most affected motor and sensory nerves were the peroneal and sural nerve, respectively. There were no significant associations between demographic data and NCS results.

The prevalence of abnormal NCS findings in this study (60.4%) was lower than in the previous report of 88% by Abuelwafaa N.[12] A possible explanation for this could be that the subject population of

the previous study was children with type1 diabetes mellitus, which is a chronic disease, thus increasing the chances of detecting abnormalities. Other explanations for the low prevalence of abnormal NCS findings in this study include the possibility that some patients may have undergone the test too early for abnormalities to be detected, some may have been misdiagnosed initially, the abnormalities may have been too subtle to be detected by the test (since the normal range of values in children can vary widely), or some patients may have small fiber polyneuropathy, which cannot be detected by the NCS test.

Regarding the pattern of nerve involvement, these results seem to be consistent with another research which found that the most frequent type was the sensorimotor type, followed by the pure motor type.[12] Pure sensory type was barely detected, which could be due to the fact that the children were unable to identify numbness. Therefore, the most common referral symptom was weakness of the limb, which was usually observed by parents. This study found that the nerve most affected was the peroneal nerve, which is similar to the study by previous study.[12]

However, the findings of this study on the association between age, sex, weight, height, duration of signs or symptoms, birth history, and abnormal findings in NCS in children with suspected polyneuropathy differed from the findings of previous studies[14-16] which found significant differences between age, sex, and duration of signs or symptoms and abnormal findings in NCS. This inconsistency might be because they recruited participants with more specific diseases.

Several limitations of this study need to be considered. First, the sample size was relatively small, so this study had insufficient statistical power to detect significant associations. Second, using secondary data from medical records or chart reviews, an information error (bias) could occur. Third, the NCS protocol could be different for each child because some children had a lack of cooperation. Therefore, further studies with a larger sample size and prospective data collection are required.

Conclusion

The prevalence of abnormal NCS findings in children with suspected polyneuropathy was 60.4%. There were no significant differences in age, sex, weight, height, duration of signs or symptoms, and birth history between the two groups. The most affected motor and sensory nerves in children with suspected polyneuropathy were the peroneal nerve and the sural nerve, respectively.

Acknowledgement

The author would like to express an appreciation to Professor Chanwit Phongamwong, Professor Chanasak Hathaiareerug for their guidance and support in analyzing the research and also want to thank

Niksa Tanongsakmontri, M.D. for her assistance throughout the project. The author is also grateful to all colleagues for their support.

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