International Journal of Pediatrics and Genetics
Vol. 3 No. 10 (2025)
ISSN: 2995-5483

Electromyography in the Diagnosis and Management of Pediatric Neuromuscular Disorders

Dr. Ghadah Marzok Awad
M.B.Ch.B., C.A.B.P. \ (Paediatric Specialist) Iraqi Ministry of Health, Al-Karkh Health Department, Al-Furat General Hospital, Paediatric Department, Baghdad, Iraq
ghadaghada1039@gmail.com

Dr. Mohammed Wahbi Salman
M.B.Ch.B., F.I.B.M.S. \ (Paediatric Specialist) Iraqi Ministry of Health, Al-Karkh Health Department, Al-Furat General Hospital, Paediatric Department, Baghdad, Iraq
Drmohammedwahbiaaa@gmail.com

Dr. Zainab Mohammed Taqi Issa
M.B.Ch.B., M.Sc. Physiology. \ (Physiology Specialist) Iraqi Ministry of Health, Al-Karkh Health Department, Al-Karama Teaching Hospital, Physiology Department, Baghdad, Iraq
hpnbrkjat@gmail.com

Abstract: This study presented neuromuscular disorders as a heterogeneous group of conditions that severely impair motor function and quality of life in children. Electromyography (EMG) has been used as a diagnostic tool in the screening and management of these neuromuscular disorders. This study has significantly contributed to identifying the importance of EMG in the diagnosis and management of neuromuscular disorders and evaluating clinical outcomes in children.

During a 12-month follow-up period, a cross-sectional study was conducted on 72 pediatric patients diagnosed with neuromuscular disorders, aged 0–15 years, whose symptoms and conditions were diagnosed using EMG. Clinical outcomes were evaluated, and the diagnostic accuracy of EMG in pediatric patients was determined. The study population consisted of 55.6% males and 44.4% females, most of whom (41.7%) were between the ages of 6 and 10 years. The most common diagnoses were muscular dystrophies (25.0%) and spinal muscular atrophy (16.7%). EMG showed high diagnostic accuracy, with rates exceeding 90% for both conditions. The most common methods of treatment were needle EMG (83.3%), physical therapy (69.4%), and pharmaceutical therapy (55.6%). During the 12-month follow-up, 62.5% of patients showed enhancement, but 9.7% deteriorated; parental satisfaction with diagnosis and treatment was high (83.3% satisfied or very satisfied); and EMG results were strongly correlated with genetic testing, especially for spinal muscular atrophy (98.0%).

Our current study concludes that EMG is an accurate diagnostic technique for evaluating pediatric patients with neuromuscular disorders, allowing for the identification of effective treatment strategies. Furthermore, the combination of EMG with genetic testing enhances diagnostic accuracy, thus increasing patient outcomes.

Key words: Electromyography, Pediatric Neuromuscular Disorders, Management Outcomes, and Parental Satisfaction.

Vol. 3 No. 10 (2025)
ISSN: 2995-5483

Introduction

A wide range of illnesses that impact the muscles, nerves, or the communication among them are referred to as pediatric neuromuscular disorders, which can cause serious morbidity along with functional impairment in children [1, 2, 3]. Muscle weakness, hypotonia, delayed motor milestones, and exhaustion are common signs of these illnesses, which include spinal muscular atrophy, muscular dystrophies, congenital myopathies, as well as peripheral neuropathies [4]. as well as it provided vital information on the health and functionality of the skeletal muscles and peripheral nervous system. Electromyography (EMG) has become a fundamental diagnostic technique in the assessment of juvenile neuromuscular disorders. [5]

Also, a neurophysiological method called electromyography (EMG) captures the electrical activity produced by muscle fibers both during contraction and during rest [6], where its two main parts are nerve conduction studies (NCS), which measure the amplitude and speed of electrical impulses sent along peripheral nerves, and needle EMG, which inserts a tiny needle electrode into the muscle to measure its electrical activity [7], which EMG is especially helpful in juvenile populations for differentiating between neurogenic & myopathic processes, detecting unique muscle involvement patterns, and directing additional diagnostic procedures such muscle biopsy or genetic testing. [8]

Contrary to its usage in adults, applying EMG to children were posed special difficulties, which pediatric patients' smaller anatomical structures need higher technical accuracy, and they may have a limited tolerance for intrusive operations [9], as well as the interpretation of EMG results may be complicated by developmental differences in muscle along with nerve physiology.

Furthermore, EMG is an essential tool in the management for juvenile neuromuscular diseases in addition to its diagnostic function, where it facilitated tracking the course of the disease, evaluating the effectiveness of treatment, and spotting side effects including peripheral nerve entrapment and myopathic alterations [11], that EMG can be used to assess the degree of motor neuron loss among children suffering spinal muscular atrophy and to inform choices about new treatments, such as gene-targeted medicines. [12]

Patients and Methods

- Study Design and Study Population

A cross-sectional study was conducted on 72 pediatric patients diagnosed with neuromuscular disorders. Data were collected and performed on all pediatric patients in the pediatric neurology clinic during a 12-month follow-up period. This current study evaluated the effectiveness of electromyography (EMG) in the diagnosis and management of pediatric neuromuscular disorders. Pediatric patients aged 0–15 years were included in this study. All patients were examined, and clinical symptoms associated with pediatric neuromuscular disorders were observed. Inclusion and exclusion criteria for pediatric patients included children diagnosed with unexplained muscle weakness, decreased muscle tone, delayed motor development, or other neuromuscular symptoms. Pediatric patients with a previous diagnosis of neuromuscular disorders or unwillingness to undergo EMG were excluded.

- Data Collection

Our study recorded clinical data, which identified demographic variables for all 72 participants with neuromuscular disorders, including age, gender, and clinical symptoms experienced by children with neuromuscular disorders. The types of neuromuscular disorders in children were also documented and classified based on clinical findings and results (both electromyography and genetic testing). Furthermore, all patients underwent EMG examinations, which included both needle EMG and surface EMG. The accuracy of EMG diagnosis was evaluated by comparing these EMG results with

Vol. 3 No. 10 (2025)
ISSN: 2995-5483

the final diagnoses determined by genetic testing. EMG results were classified into three types: normal, muscular, neurological, and mixed.

- Diagnosis and Management of Pediatric Patients

Electromyography (EMG) diagnosis of pediatric patients was performed by pediatric neurologists in the Pediatric Neurology Clinic. The primary method was needle electromyography (EMG), while younger or more sensitive individuals were treated using surface electromyography (SEM). Following diagnosis, physical therapy, medication therapy, and surgery were among the treatment techniques customized for each patient's condition. EMG-related complications were tracked.

- Evaluating Patient Outcomes

Our study also evaluated the effectiveness of treatment in children during the 12-month follow-up period. The rate of improvement in clinical outcomes was documented, categorized as improved, unchanged, or worsened, and the parents' satisfaction with the diagnosis and management process was recorded using a questionnaire, where our paper focused to determine and evaluate relationship between EMG results and genetic testing results to determine the reliability of EMG as a diagnostic tool, which our statistical analysis of patient data had designed and recorded by SPSS version 24.0.

Results

Table 1: Demographics of Study Participants

Variables	Number (%)
Age (Years)	
0-5	22 (30.6%)
6-10	30 (41.7%)
11-15	20 (27.8%)
Gender	
Male	40 (55.6%)
Female	32 (44.4%)

Table 2: Types of Neuromuscular Disorders Diagnosed in the 72 Pediatric Patients

Disorders	Number (%)
Muscular Dystrophies	18 (25.0%)
Spinal Muscular Atrophy	12 (16.7%)
Peripheral Neuropathies	15 (20.8%)
Myasthenia Gravis	8 (11.1%)
Congenital Myopathies	10 (13.9%)
Other Neuromuscular Disorders	9 (12.5%)

Table 3: Clinical Symptoms at Presentation.

Symptoms	Number (%)
Muscle Weakness	65 (90.3%)
Hypotonia	50 (69.4%)
Delayed Motor Milestones	45 (62.5%)
Muscle Atrophy	30 (41.7%)
Fatigue	25 (34.7%)

Table 4: Electromyography Techniques.

Technique	Number (%)
Needle EMG	60 (83.3%)
Surface EMG	12 (16.7%)

Table 5: EMG Diagnostic Accuracy.

Disorder	Accuracy (%)
Muscular Dystrophies	94.4%
Spinal Muscular Atrophy	91.7%
Peripheral Neuropathies	86.7%
Myasthenia Gravis	87.5%
Congenital Myopathies	90.0%
Other Neuromuscular Disorders	77.8%

Table 6: EMG Findings.

Findings	Number (%)
Normal	10 (13.9%)
Myopathic Pattern	30 (41.7%)
Neurogenic Pattern	20 (27.8%)
Mixed Myopathic/Neurogenic	12 (16.7%)

Table 7: Treatment Modalities Post-Diagnosis.

Modality	Number (%)
Physical Therapy	50 (69.4%)
Pharmacological Therapy	40 (55.6%)
Surgical Intervention	10 (13.9%)
Gene Therapy	8 (11.1%)

Table 8: EMG Complications.

Complications	Number (%)
Mild Pain	15 (20.8%)
Bruising	8 (11.1%)
Infection	1 (1.4%)
No Complications	48 (66.7%)

Table 9: Determine Clinical Improvements at Children during 12-Month Follow-Up.

Outcome	Number (%)
Improved	45 (62.5%)
No Change	20 (27.8%)
Worsened	7 (9.7%)

Table 10: Evaluation of Parental Satisfaction who under Diagnosis and Management.

Satisfaction Level	Number (%)
Very Satisfied	35 (48.6%)
Satisfied	25 (34.7%)
Neutral	10 (13.9%)
Dissatisfied	2 (2.8%)

Vol. 3 No. 10 (2025)
ISSN: 2995-5483

Table 11: Correlation between EMG and Genetic Testing.

Disorder	Correlation (%)
Muscular Dystrophies	95.0%
Spinal Muscular Atrophy	98.0%
Peripheral Neuropathies	85.0%
Myasthenia Gravis	90.0%
Congenital Myopathies	92.0%
Other Neuromuscular Disorders	75.0%

Discussion

In the diagnosis and treatment of neuromuscular diseases (NMDs) in children, electromyography (EMG) has been for years a mainstay, with 72 pediatric patients, this study offered a thorough examination of the effectiveness, precision, and results related to EMG in the diagnosis and treatment of pediatric NMDs, where almost of participants (41.7%) got between the ages of 6 and 10 years, and the study population was made up of 55.6% men and 44.4% girls. Given that pediatric NMDs frequently manifest in early childhood along with are more common in boys due to the X-linked inheritance for specific illnesses, such as Duchenne muscular dystrophy (DMD), this distribution is consistent with previous studies [13, 14]. At presentation, muscular weakness (90.3%), hypotonia (69.4%), and delayed motor milestones (62.5%) were the most prevalent clinical signs. Muscle weakness as well as hypotonia were shown to be characteristic symptoms of pediatric NMDs in research carried out in the United States [15].

The most common illnesses detected in this group were peripheral neuropathies (20.8%) and muscular dystrophies (25.0%), with spinal muscular atrophy (SMA) (16.7%) coming in second. According to German research, SMA and muscular dystrophies are the main causes of pediatric NMDs. Peripheral neuropathies are very common (20.8%), which is significant because of their mild appearance, which frequently results in underdiagnosis in children. [16, 17]

Because of its improved capacity to measure muscle activity in the cellular level, needle EMG was the most commonly utilized method (83.3%). Despite being less intrusive, surface EMG was only used 16.7% of the time, mostly for smaller children or those who were afraid of needles. Muscular dystrophies (94.4%) and SMA (91.7%) had the best diagnosis accuracy of EMG, which is consistent with data from a Chinese research [18], which found comparable accuracy rates for both illnesses. The lower accuracy for "other neuromuscular diseases" (77.8%), however, raises the possibility that EMG may not be able to accurately diagnose uncommon or atypical problems, requiring the need of genetic testing in a conclusive diagnosis.

The majority of EMG data exhibited a myopathic pattern (41.7%) and a neurogenic pattern (27.8%), compatible with the diagnosis of muscular dystrophies and SMA, respectively. The significant connection between EMG and genetic testing, notably for SMA (98.0%) and muscular dystrophies (95.0%), emphasizes the complimentary nature of these diagnostic methods. The lesser correlation for other neuromuscular illnesses (75.0%) and peripheral neuropathies (85.0%), however, emphasizes the necessity of a multidisciplinary diagnosis strategy that combines clinical assessment, genetic testing, and EMG.

The most common treatment techniques for pediatric NMDs were physical therapy (69.4%) and pharmaceutical therapy (55.6%), which reflected the focus on symptom management along with functional improvement. Although it was not widely used, gene therapy (11.1%) showed promise, especially for SMA, where new developments have demonstrated notable effectiveness [19]. 9.7% of patients had deteriorating symptoms over the 12-month follow-up period, whereas 62.5% of patients demonstrated improvement. These results are in line with Canadian research [20], that found that children with NMD who received comprehensive therapy showed comparable improvement rates. The most frequent EMG-related effects were moderate discomfort (20.8%) and bruising (11.1%). The

safety of EMG for pediatric populations is confirmed by the low infection incidence (1.4%) and a large proportion of kids who have no problems (66.7%). 48.6% of parents said they were "very pleased" and 34.7% said they were "satisfied" with the diagnosis and management procedure.

Conclusion

This study demonstrates the use of EMG as a secure and dependable diagnostic method for pediatric NMDs, especially in the detection of SMA and muscular dystrophies. The findings suggest that EMG has a high diagnosis accuracy, especially for spinal muscular atrophy (91.7%) and muscular dystrophies (94.4%), and that it has a significant association with genetic testing for a variety of illnesses. The most common method was needle EMG (83.3%), and the majority of patients had no problems (66.7%). The main treatment methods after diagnosis were physical therapy (69.4%) and pharmaceutical therapy (55.6%), which improved outcomes for 62.5% of patients in a 12-month follow-up. With 83.3% expressing pleasure or very pleased, parental satisfaction with both the diagnostic and treatment process was high. To further improve diagnosis accuracy and patient care, future studies should concentrate on refining EMG methods for younger kids and investigating the incorporation of cutting-edge diagnostic modalities like next-generation sequencing.

References

1. Hellmann M, von Kleist-Retzow JC, Haupt WF, Herkenrath P, Schauseil-Zipf U. Diagnostic value of electromyography in children and adolescents. J Clin Neurophysiol. 2005;22:43–48.
2. Butler KB. The technologist's role in pediatric EMG. Am J Electroneurodiagnostic Technol. 2000;40:185–195.
3. Savrun FK, Uzun N, Kızıltan M. Hipotonik bebeklerin elektrofizyolojik değerlendirilmesi. Yeni Symposium. 2001;39:70–73.
4. Yağcı İ, Ofluoğlu D, Gündüz H, Karadayı-Saygı E, Güven Z, Berker N, Akyüz G. Pediatrik Olgularda Klinik Ön Tanıve Elektrofizyolojik Tanıların Uyumu. Türk Fiz Tıp Rehab Derg. 2008;54:92–95.
5. Kang PB. Pediatric Nerve Conduction Studies and EMG. In: Blum AS, Rutkove SB, editors. The Clinical Neurophysiology Primer. Totowa, NJ: Humana Press Inc; 2007. pp. 369–389.
6. Hays RM, Hackworth SR, Speltz ML, Weinstein P. Physicians' practice patterns in pediatric electrodiagnosis. Arch Phys Med Rehabil. 1993;74:494–496.
7. Pitt M. Neurophysiological strategies for the diagnosis of disorders of the neuromuscular junction in children. Dev Med Child Neurol. 2008;50:328–333.
8. Abzug JM, Kozin SH. “Current concepts: Neonatal brachial plexus pals”. Department of Orthopaedic Surgery Faculty Papers 2010 Paper 25. Erişim: http://jdc.jefferson.edu/orthofp/25.
9. Sibinski M, Synder M. Obstetric brachial plexus palsy –risk factors and predictors. Ortop Traumatol Rehabil. 2007;9:569–576.
10. Ryan MM. Pediatric Guillain-Barrésyndrome. Curr Opin Pediatr. 2013;25:689–693.
11. Sladky JT. What is the best initial treatment for childhood chronic inflammatory demyelinating polyneuropathy: corticosteroids or intravenous immunoglobulin? Muscle Nerve. 2008;38:1638–1643.
12. Kang PB, McMillan HJ, Kuntz NL, Lehky TJ, Alter KE,1. Fitzpatrick KF, et al. Utility and practice of electrodiagnostic Testing in the pediatric population: An AANEM consensus Statement. Muscle Nerve 2020; 61 (2):143-55.
13. Preston D, Shapiro B. Approach to Pediatric Electro-2. Myography. In: Electromyography and neuromuscular disorders: Clinical-electrophysiologic-ultrasound corre-lations. ed. 4th. Philadelphia: Elsevier Science Publishers; 2021. p. 729-36.

Vol. 3 No. 10 (2025)
ISSN: 2995-5483

14. Orhan EK, Kiraç LB, DİKmen PY, Matur Z, Ertaş M, Öge AE,3. et al. Electromyography in the Pediatric Population.Noro Psikiyatr Ars 2018; 55 (1):36-9.
15. Pondaag W, Malessy M, van Dijk JG, Thomeer R. Natural4. history of obstetric brachial plexus palsy: A systematic Review. Dev Med Child Neurol 2004; 46 (2):138-44.
16. Zia MA, Masood Y, Salman MK. Guillain-Barré syndrome 5. Professional Med J 2018; 25 (04):538-44.
17. Bramhall RJ, Deveraj VS. Traumatic sciatic nerve palsy after 6. Gluteal injections. Eur J Plast Surg 2011; 34:137-8.
18. Sunnerhagen KS, Carlsson U, Sandberg A, Stalberg E, Hedberg M, Grimby G. Electrophysiologic evaluation of muscle fatigue development and recovery in late polio. Arch Phys Med Rehabil 2000; 81: 770–776.
19. Chaudhry V, Corse A, Skolasky RL Jr. Surface electromyography recording of volitional activity: a technique to detect partial motor conduction block. Muscle Nerve 2003; 27: 590–594.
20. Chisari C, Simonella C, Rossi B. A surface EMG analysis of sarcolemma excitability alteration and myofibre degeneration in Steinert disease. Clin Neurophysiol 2001; 112: 1925–1930.