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UTILITY OF PUDENDAL NERVE ELECTRODIAGNOSTICS IN CASES OF BLADDER-BOWEL DYSFUNCTION- A RETROSPECTIVE STUDY FROM A TERTIARY CARE CENTER IN PAKISTAN

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ABSTRACT

Background and Objective:

Electrodiagnostic studies play a crucial role in identifying neurogenic and non-neurogenic causes of bladder and bowel dysfunction. Such data is scarce in Pakistan. The objective of this study was to evaluate utility of pudendal nerve assessment in bladder-bowel dysfunction.

Methods:

A retrospective observational study was carried out at the neurophysiology lab in Aga Khan University Hospital. Patients referred for electromyography/nerve conduction studies (EMG/NCS) for pudendal nerve assessment from June 2013 to June 2023 were included. Clinical data, EMG/NCS results, and demographic information were analyzed using SPSS.

Results:

Twenty patients (11 male and nine female) were included. Five patients experienced backache radiating to one or both lower extremities, along with urinary or fecal incontinence. Three patients had urinary incontinence, and additional three presented with both urinary and fecal incontinence. Three patients reported perianal numbness. Four patients had fecal incontinence, while one patient each reported painful defecation and backache along with perianal numbness. Three patients were diagnosed with pudendal neuropathy, out of which one had a coexisting lumbosacral radiculopathy as well. Five patients had isolated lumbosacral radiculopathy. Twelve patients exhibited normal EMG/NCS results.

Conclusion:

This study highlights the diagnostic utility of EMG/NCS in diagnosing pudendal nerve injuries. Despite its widespread use worldwide, the utilization of these tests in Pakistan is hindered by factors such as limited awareness, inadequate training, and resource constraints.

Keywords: Electromyography/Nerve conduction studies, pudendal nerve, bladder dysfunction, bowel dysfunction

INTRODUCTION

The Pelvic region is supplied by both somatic and autonomic nerve supply.¹ Somatic innervation is via the pudendal nerve which arises from nerve roots S2, S3 and S4 of the sacral plexus. Its sensory branch innervates the external genitalia and skin around anus, anal canal, and perineum. Its motor branch innervates muscles of the pelvic floor, external urethral and external anal sphincter.² Neurophysiological tests check electrical activity of nerves and muscles of the affected area that have somatic innervation.

Electrodiagnostic testing helps localize the site of nerve pathology along the pudendal nerve pathway.³ By assessing both sensory and motor nerve conduction, it provides objective evidence of nerve dysfunction, which can aid in distinguishing pudendal neuropathy from other potential causes of pelvic pain and sexual dysfunction.⁴

Herein, we evaluated 20 patients who underwent electromyography/nerve conduction studies (EMG/NCS) for evaluation of pudendal nerve injury. Our study demonstrates the diagnostic utility of EMG/NCS

in patients with bladder and bowel dysfunction, highlighting the role of electrophysiology in accurate diagnosis and targeted management. This study is also significant, as there is currently no existing literature in Pakistan highlighting its significance in this context. Therefore, our literature sheds light on the crucial role of neurophysiological testing in bladder and bowel dysfunction in Pakistan.

METHODS

The study was carried out at Aga Khan University Hospital recording data of 10 years from June 2013 to June 2023. It was a retrospective observational cross sectional study. The inclusion criteria was patients above 18 years of age who visited the neurophysiology department as outpatient and underwent EMG/NCS specifically for the evaluation of pudendal neuropathy. Exclusion criteria included all patients with contraindication to EMG/NCS or those with missing data.

Relevant information regarding the patient's age, gender, reason of referral, and EMG/NCS findings were extracted from the patient's records. Ethical approval for the study was obtained from the Ethical Review Committee. The electrodiagnostic study involved conducting motor and sensory nerve conduction studies on bilateral lower extremities along with pudendal nerve assessment followed by needle electromyography examination of the same. The Nihon Kohden machine from South Africa (Model number: Neuropack S1MEB-940) was used for all the studies. The motor and sensory NCS were carried out as per the established protocol, and the nerves examined included sural, peroneal, posterior tibial, and pudendal

nerves. Electromyography examination of the lower extremity muscles along with levator ani and anal sphincter muscles at 3:00, 6:00 and 9:00 o clock was performed using disposable needles. Kiff's method was used for pudendal nerve assessment. According to the Kiff method, the pudendal nerve was stimulated through surface electrodes. An electrical stimulus was given and this stimulus generated an action potential that was recorded from nearby muscles, such as the external anal sphincters or the pelvic muscles. Sphincter EMG involved recording the electrical activity of the anal sphincter muscles using needle electrodes inserted into the muscle tissues. Parameters such as amplitude and duration of motor unit action potentials (MUAPs), as well as recruitment, interference pattern, and denervation were evaluated during the needle electromyography examination. Latencies on the right and left within the range of 1.5 to 2.6 msec were considered normal.

Data analysis was performed using SPSS for windows, version 22.

RESULTS

A total of 20 adult patients underwent EMG/NCS for pudendal nerve assessment. Among them, 11 (55 %) were male, and nine (45 %) were female, with ages ranging from 22 to 73 years and a mean age of 43.85. Five patients experienced backache radiating to one or both lower extremities, along with urinary or fecal incontinence. Three patients had urinary incontinence, and additional three presented with both urinary and fecal incontinence. Additional clinical details are given in Table 1.

Table 1: Clinical details of the patients

		Number of patients (n=20)	Percentage (%)
Gender	Male	11	55
	Female	9	45
Reason of procedure	Urinary incontinence	3	15
	Fecal incontinence	4	20
	Urinary+ Fecal incontinence	3	15
	Perianal numbness/pain	3	15
	Backache radiating to both legs+ sexual dysfunction (Erectile dysfunction)%	5	25
	Backache plus perianal numbness	1	5
	Painful defecation	1	5

EMG/NCS results showed that two patients exhibited pure pudendal neuropathy. An even more intriguing case involved a patient with both pudendal neuropathy and a lumbosacral radiculopathy. Meanwhile, five patients demonstrated isolated lumbosacral radiculopathy, while the majority, comprising twelve patients, displayed normal EMG/NCS results.

DISCUSSION

In the context of bladder and bowel dysfunction, EMG/NCS for pudendal nerve studies plays a pivotal role in guiding effective treatment strategies by accurately diagnosing nerve injuries and dysfunction. Our study emphasizes the importance of incorporating these specialized neurophysiological tests in the diagnostic algorithm for patients presenting with bladder and bowel dysfunction. In Pakistan, despite the global recognition of the significance of pudendal nerve studies, their utilization remains limited due to various challenges.

In our present study, three patients were diagnosed with pudendal neuropathy. Interestingly, one of these patients had a prior history of resection of Ewing's sarcoma, and had a mass in the sacral area, raising concerns about nerve involvement contributing to fecal incontinence. This patient also had superimposed radiculopathy. The cause of neuropathy was likely direct nerve involvement from the tumor or surgical interventions. Several causes could be proposed regarding the potential causes of isolated pudendal neuropathy observed in the other two patients. The neuropathy in these patients might be attributed to a localized injury or entrapment of the pudendal nerve, possibly due to anatomic variations, repetitive trauma, or idiopathic factors.

Another interesting case that we came across was that of a 32-year-old gentleman who came with urinary and fecal incontinence for two years. He had a lumbar puncture done one day prior to developing these symptoms. He was diagnosed with bilateral L4-S3 radiculopathy suggesting a traumatic injury to nerve roots secondary to lumbar puncture. This case is noteworthy because there have been only a few reported instances of fecal incontinence following a traumatic lumbar puncture worldwide.^{5,6} The electrophysiological evaluation played a crucial role in assisting with the diagnosis of pudendal neuropathy and ruling out subclinical nerve damage in the remaining cases. These findings highlight the

importance of incorporating EMG/NCS in the diagnostic algorithm for bladder and bowel disorders, aiding in accurate diagnosis and targeted management.

Studies by Panicker et al, Popeney et al, and Valles-Antuña C et al have also highlighted the importance of neurophysiological testing in various pelvic disorders. These studies discuss the clinical utility of different tests, such as EMG, evoked potentials, and bulbocavernous reflex in diagnosing urinary bladder voiding dysfunction, pudendal nerve entrapment, and pelvic floor electrophysiological patterns, respectively.⁷⁻⁹

Another notable study by Sultan HA et al focused specifically on fecal incontinence and its associated pelvic floor electrophysiological patterns. The investigation involved a total of 40 patients with findings compared to a healthy control group. The study revealed that bilateral pudendal neuropathy was the most common cause of fecal incontinence, occurring in 72.5% of the patients, followed by unilateral pudendal neuropathy (12.5%). The causes ranged from rectal descent and labor traction neuropathy to traumatic or iatrogenic injury to anal sphincters. The author highlighted the utility of electromyographic mapping of external anal sphincter as a good tool to detect a local defect.¹⁰ These studies provide valuable insights into the diagnostic significance of neurophysiological testing in pelvic disorders.

To the best of our knowledge, there have been no previous studies in Pakistan that highlight the importance of neurophysiological testing in urinary and fecal incontinence particularly pudendal nerve electrodiagnostic exams such as EMG/NCS. This can be attributed to various factors, including limited awareness and training among health care professionals, resource constraints in terms of equipment availability and costs, reliance of standard clinical evaluation and imaging studies for diagnosis, and societal taboos associated with discussing pelvic disorders. It is important to raise awareness about the diagnostic utility of these specialized exams and advocate for training programs to enhance the knowledge and skill of healthcare professionals in conducting and interpreting these studies. Additionally, allocating resources to improve access to these exams can help overcome the barriers and increase their utilization in the future. Our study contributes to raising awareness about the importance of electrodiagnostic

studies in countries where discussing bladder and bowel issues may be considered a taboo.

A major limitation of our study is its relatively small size. But then again this may be attributed to the lack of awareness among people. Also, this is a retrospective study that may contain certain biases that could not be excluded.

CONCLUSION

Our study highlights the diagnostic utility of EMG/NCS in diagnosing pudendal nerve injuries. Despite its

widespread use worldwide, the utilization of these tests in Pakistan is hindered by factors such as limited awareness, inadequate training, and resource constraints. It is crucial to enhance awareness, provide training opportunities, and allocate resources to promote the effective evaluation and management of pelvic disorders in societies where discussing such matters may face taboo.

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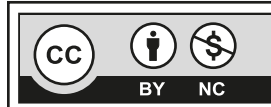
Hina Imtiaz; design, data collection, data analysis, manuscript writing

Ayisha Farooq Khan; concept, data analysis, manuscript writing

Zuha Alvi; data collection, manuscript writing

Dureshahwar Kanwar; concept, manuscript revision

The authors have approved the final version of the article, and agrees to be accountable for all aspects of the work.



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