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Clinical and Electrophysiological Study of Peripheral Neuropathy in Upper Limb of Children on Hemodialysis Treatment

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Abstrac: This study sought to determine the prevalence and predictors of peripheral neuropathy in children with chronic kidney disease (CKD). is to evaluate the clinical and electrophysiological abnormalities in upper limbs of children on hemodialysis treatment at dialysis unit at Benha university Hospital. Our study was acase control study (descripitive and comparative). The study will be conducted on 60 children The CKD group consisted of 30 patients, all of them complained from end stage irreversible renal failure, 20 on hemodialysis (GFR<15ml/min/1.73m^2) and 10 on conservative treatment (GFR<60ml/min/1.73m^2) divided according to shwartz formula

1-Introduction

The K/DOQI workgroup defined CKD as follows: The presence of markers of kidney damage for ≥3 months, as defined by structural or functional abnormalities of the kidney with or without a decreased glomerular filtration rate (GFR), that is manifested by either pathological abnormalities or other markers of kidney damage, including abnormalities in the blood, urine, or in imaging tests or GFR <60 mL/min per1.73 m^2 for ≥3 months, with or without kidney damage. The broader implication of this common definition is that patients with CKD can be identified earlier so that progression towards end-stage renal disease (ESRD) can be halted or slowed [1].

Peripheral neuropathy (PN) is a disorder that affects the cell body, axon or myelin of motor or peripheral sensory neurons and can respectively be classified as neuropathological, axonal or demyelinating. This condition is either hereditary or acquired and may be further subdivided into sensory, motor or autonomic. PN has a large spectrum of causes (such as nutritional deficiencies and toxic neuropathies as well as clinical presentations; however, constant and recurring pain occurs in almost all types of this disorder [2].

The overall prevalence of peripheral neuropathy is 2.4%. However, this number increases exponentially in certain age groups, and it may even be an underestimate since traumatic causes are not included in this percentage [3].

Peripheral neuropathy occurs in 60-100% of patients who are submitted to dialysis due to chronic kidney disease (CKD). Uremic neuropathy (UN) occurs when renal dysfunction impairs filtration, leading to the accumulation of organic waste. This is evident in patients with reduced glomerular filtration rate (GFR) usually attributed to end-stage renal disease (ESRD) [4].UN is a distal symmetric sensorimotor polyneuropathy that typically affects lower limbs and is due to length-dependent axonal degradation and secondary focal loss of myelin sheaths [5].

This is considered a demyelinating condition which leads to axonal degeneration and loss [6].

2-Subjects& methods

2.1Study Design:

Case control study (Descriptive and comparative).

It conducted over 6 months from febreuary2019 to July 2019

2.2Size of samples:

The study will be conducted on 60 children

Informed written consent will be taken from their parents to share in this study.

2.3Criteria:-

A- Inclusion criteria :

- Age: 3-18 years old.
- Both sex.
- Patients on hemodialysis treatment.
- Patients on conservative treatment of chronic kidney disease stage IV.
- **Exclusion criteria:**
  - Above 18 years, less than 3 years.
  - The patient with DM.
  - The patient with other medical condition that cause peripheral neuropathy.

2.4METHODS

All children were subjected to the following:

2.5History taking:-

2.6Examination:

2.7Neurological examination:

2.8Laboratory investigation:

- Blood samples have been taken before dialysis session and before electrophysiologic examination:
- KFT: Urea, creatinine.
- Serum electrolytes: Na, K, Ca.
- CBC,ABG

2.9Electrophysiological studies:

3.Results:

There is no significant difference in sex and residence in the studied groups but the

passive smoking and the family history of CRF is statistically significant as shown in table [1].

Table (1) Comparison between group I (n=20) and group II (n=10), group III (n=30) regarding demographic data, FH for CRF and FH for peripheral neuropathy.

	Group I (n=20)		**Group II (n=10)**		**Group III (n=30)**		**Test of sig.**	**P-value**
	No.	**%**	**No.**	**%**	**No.**	**%**		
Sex								
Male	10	50	2	20	16	53.3	3.64*	0.176
Female	10	50	8	80	14	46.7		
Age								
Min. – Max.	8 – 18		8 – 18		8-18		36.6**	.000
Mean ± SD	15.5 ± 3.0		12.5 ± 3.5					
Residence								
Urban	10	50	3	30	23	76.7	8.07*	.018
Rural	10	50	7	70	7	23.3		
Passive smoking							7.92*	0.019
Positive	11	55	9	90	26	86.7		
Negative	9	45	1	10	4	13.3		
Family history of CRF							13.3*	.001
Yes	6	30	0	0	0	0		
No	14	70	10	100	30	100		
Family history of peripheral neuropathy							8.57*	.014
Yes	4	20	0	0	0	0		
No	16	80	10	100	30	100		

Comment:

The differences in the above baseline factors between the studied three groups were significant except for sex. Multivariate analysis is required to adjust for these factors

Table (2) comparison between group I, group II and group III according to neurological symptoms, neurological examination and autonomic neuropathy.

	Group I (n=20)		**Group II (n=10)**		**Group III (n=30)**		**Test of sig.***	**P-value**
	No.	**%**	**No.**	**%**	**No.**	**%**		
Symptoms of PN								
Yes	5	25	3	30	0	0	9.37	.009
No	15	75	7	70	30	100		
Symptoms of autonomic neuropathy								
Yes	6	30	1	10	0	0		.005
No	14	70	9	90	30	100	10.5	
Neurological examination								
Normal	9	45	10	100	27	90	17.24	.000
Abnormal	11	55	0	0	3	10		

Comment: The three groups significantly differed in frequencies of neurological symptoms, neurological examination and autonomic neuropathy; HD patients showed the highest percentages compared with other groups.

Table (3) Symptoms of PN among uremic neuropathy patients in both group

		Neuropathy		Test statistic	Sig.
		Yes	No		
Symptoms of PN	Yes	8 (100%)	0 (0 %)	41.1	0.00**
	No	3 (5.8%)	49 (94.2%)		
Symptoms of autonomic neuropathy	Yes	6 (85.7%)	1 (14.3%)	24.03	0.00*
	No	5 (9.4%)	48 (90.6%)		

Values expressed as frequencies (percentage), *: significant difference at p< 0.05, **: significant difference at p< 0.01. Chi-square test was used.

There was a significant association between neuropathy and symptoms of each PN and autonomic neuropathy (P < 0.01).

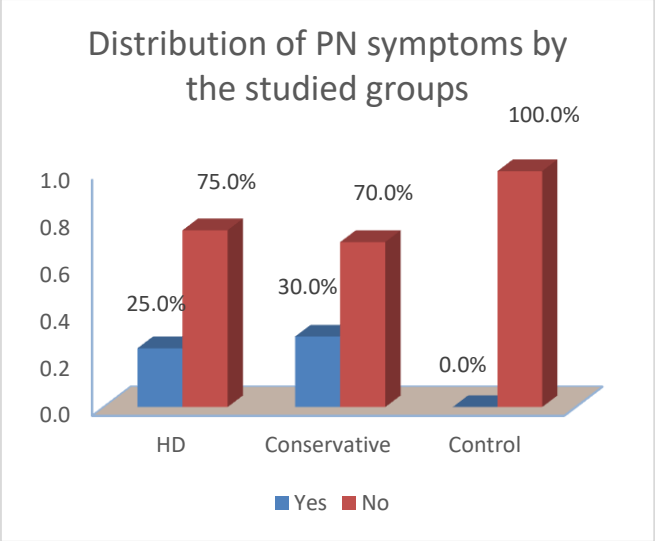

Fig [1] Distribution of symptoms by the studied groups

The figure show that 25% of group I and 30% of group II had symptoms of neuropathy.

4.Discussion

Peripheral nerve neuropathy can be classified roughly into two pathological typesone mainly due to axonal degeneration, and one mainly due to demyelination[7].

Electrophysiologically, nerve conduction studies of the four extremities have demonstrated decreased amplitude of the evoked potentials in the former type and decreased conduction velocity in the latter type. The pathological state of uraemic neuropathy is a multiple neuropathy due to axonal degeneration of the sensory and motor nerves starting from the lower extremities with secondary development of demyelination [8].To evaluate the presence or absence of uraemic neuropathy in patients undergoing haemodialysis, we conducted nerve conduction studies of the lower extremities in haemodialysis patients and compared the results with those of normal subjects. The sensory nerve conduction studies showed reduction of the medial plantar nerve conduction velocity in the haemodialysis patients compared with the normal subjects. Recording was impossible in 13% of the haemodialysis patients for the sural nerve and in 46% for the medial plantar nerve. However, recording was also impossible in 10% of the normal subjects for the sural nerve and in 15% for the medial plantar nerve. The cause of this failure of recording may have been the effect of age [9].because small amplitude evoked potentials of a sensory nerve are known to be affected by aging. On the other hand, the CMAP and the F wave of the motor nerves were obtained successfully in all the haemodialysis patients. The tibial nerve MCV decreased compared with that of the normal subjects. However, the tibial nerve DML, which reflects disturbance of the distal peripheral nerve, and the minimal F wave latency [10]. Which is the most sensitive parameter in detecting slightly delayed conduction observed in peripheral axonal neuropathy, were prolonged. From the electrophysiological results, we predicted a high incidence of uraemic neuropathy in patients undergoing haemodialysis.

The haemodialysis patients were divided into three groups according to the duration of haemodialysis, and the values measured in the nerve conduction studies of the groups were compared. With prolongation of the duration of haemodialysis, the median nerve DML was prolonged, and the MCV and the SCV decreased in the upper extremities. On the other hand, in the lower extremities, there were no apparent changes in the tibial nerve MCV, the sural nerve SCV, and the medial plantar nerve SCV. In reviewing these results, the known increased incidence of carpal tunnel syndrome in haemodialysis patients with prolongation of haemodialysis duration may serve as a good comparative example (31% to 57% at more than 10 years, and 71% at more than 20 years). Because the median nerve evoked potential was obtained from the abductor pollicis muscle and index finger by stimulating the wrist joint, the median nerve DML and SCV might have been affected by median neuropathy because of carpal tunnel syndrome. The forearm motor nerve conduction velocity, which represents the

function of the nerves proximal to the carpal tunnel, also decreased. This decrease may be explained by development of retrograde degeneration of the nerve fibres [11].and selective injury of the thick fibresby mechanical compression at the entrapment point. Therefore, the effect of entrapment neuropathy on the median nerve impedes evaluation of the severity of uraemic neuropathy using the upper extremities. The lower extremities allow precise evaluation of the severity of uraemic neuropathy because they rarely develop tarsal tunnel syndrome [12].Which is an entrapment neuropathy. Our nerve conduction studies of the lower extremities demonstrated the absence of changes in the tibial nerve DML, the tibial nerve MCV, the values measured by the tibial nerve F wave conduction study, the sural nerve SCV, and the medial plantar nerve SCV in the patient groups with different haemodialysis durations. Only the tibial nerve DML was prolonged after five years. The medial plantar nerve SCV, which reflects the most distal peripheral nerve function, was not reduced, and there were no significant changes in the other values measured, including the minimal F wave latency [13].which does not accompany reduction in the tibial nerve MCV and is most reproducible among all the nerve conduction studies. Reproducibility of the tibial nerve DML is problematic; its value has shown the most variability among nerve conduction parameters. Even in the nerve conduction studies, the measurement values of tibial nerve DML vary greatly, and their reproducibility has been considered troublesome. The minimal F wave latency was the least variable with a fluctuation rate of 5%, and the tibial nerve MCV showed a fluctuation rate of approximately 10%. However, the tibial nerve DML varied greatly, with a variation rate of 24%, and the low reproducibility has been attributed to insufficient intensity of stimulation of the tibial nerve at the ankle due to some anatomical factors. Many previous reports have described chronological reductions in the nerve conduction velocities during haemolysis [14].In the present study, the addition of an F wave conduction study, which showed less fluctuation of the measured values, enabled us to demonstrate that the severity of uraemic neuropathy remains unchanged during haemodialysis.

5-Conclusion:

From this study we conclude that:

Peripheral neuropathy is common among children with chronic renal failure on hemodialysis and on conservative treatment, Thereafter a multidisciplinary approach for prevention, diagnosis and treatment of these types of complications is crucial. andThe most common type of uremic neuropathy is sensorymotor, poly neuropathy.

6-Recommendation:

More than quarter of the children with CKD stages IV and V in this study had peripheral neuropathy. We conclude that periodic electrodiagnostic studies should be performed in children with CKD to assess for peripheral neuropathy for the purpose of optimizing medical care**.**

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