

A Study on Peripheral Nerve Dysfunction in Chronic Kidney Disease

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Abstract

Back ground:

Aim: Evaluation of overt and subclinical neuropathy in Chronic Kidney Disease (CKD) subjects and their relationship with severity and duration of the CKD.

Methodology: Diagnosed 111 non dialyzed CKD subjects attending medical ward of the tertiary care hospital consisting of 71 males and 40 females were selected. Among them 72 (64.9%) subjects consisting of 54 males and 18 females after undergoing diagnostic tests were assessed and identified as Peripheral Nerve Dysfunction (PND) subjects. They had been analyzed and interpreted according to the aim of the study.

Results: Among the total CKD, 48.6% males and 16.3% females were affected by PND. PND incidence of males was statistically significant ($P < 0.001$). The incidence of CKD and PND were 27.9% and 27.8% as maximum in the ages between 35-44 years and hence the mean ages of CKD and PND subjects were not statistically significant ($P > 0.05$). Among the total CKD, the incidence of PND within 3 years was 19.8% and 3+ years was 45.1%. No PND was 23.4% within 3 years and 11.7% was 3+ years. This revealed that the incidence of PND was significantly correlated with duration of CKD ($P < 0.001$). Among the PND subjects, the sensory motor was 23.6% and 5.6% of sensory and motor was 5.6% in respect of overt. In respect of subclinical the sensory motor was 29.2% and sensory & motor was 41.7%. The differences were significant ($P < 0.001$). The males were strongly associated with the incidence of PND with < 15 ml/mt creatinine ($P < 0.001$). The PND of females did not correlated with the creatinine ($P > 0.05$).

Discussion: The PND incidence among the CKD was 64.9%. The males affected and significantly associated was 48.6% of incidence ($P < 0.001$). The PND affected was maximum (27.8%) in the age bracket of 35-44 years. The mean age of the PND subjects (41.8 ± 17.7) was equal to the mean age of CKD subjects (42.6 ± 14.3) and ($P > 0.05$). The incidence of PND among the CKD was significantly increasing according to the duration of CKD ($P < 0.001$). The PND incidence was significantly correlated with creatinine < 15 ml/mt in respect of males. But PND was not significantly associated with the level of creatinine ($P > 0.05$).

Conclusion: The incidence of PND was very strongly associated with severity and duration.

Keywords: CKD, PND, incidence, association, duration, creatinine,

I. Introduction

Aim of the study

1. To evaluate the incidence of overt neuropathy and subclinical neuropathy in chronic kidney disease subjects attending our hospital.
2. To correlate the incidence of peripheral neuropathy with reference to the severity and duration of the chronic kidney disease.

II. Materials and Methods

The study was conducted at the medical wards of Tirunelveli medical college hospital, Tirunelveli during the period of May 2012 - April 2014. Patients with proved clinical, bio-chemical parameters in favour of Chronic Kidney Disease (CKD) are included in this study. All patients included in this study were not on dialysis.

Inclusion criteria for CKD 1 Serum creatinine more than 2 mg %

2. Creatinine clearance < 40 ml /minute. Calculated using the formula Cockcroft - Gault equation:
(140 — age) x Body weight in kg

=

$\frac{72 \times \text{Pcr (mg/dl)}}{100}$

3. Ultrasound abdomen — kidney size < 9 cm

Patients with electrophysiological evidence of peripheral neuropathy without clinical signs and symptoms were considered subclinical neuropathy.

Exclusion criteria: Patients with other recognizable risk factors for peripheral neuropathy are excluded from the study. Diabetes mellitus, Alcoholism, Drug induced peripheral neuropathy and Hansen's disease.

Totally 111 patients were studied. The duration of renal failure varies from 3 months to 7 years. A detailed history was taken in all patients with special reference to 1. Renal symptoms like scanty micturition, swelling of legs, face, Loss of appetite, Nausea, vomiting and Pruritis.

2. Symptoms in favour of peripheral nerve involvement like numbness, pins and needle sensation defective appreciation of pain and weakness, thinning of muscles were also asked for.

3. Symptoms suggestive of autonomic disturbances like absence of sweating, variation of skin temperature, postural giddiness, post micturition dribbling, fecal incontinence, defective sexual dysfunction in the form of failure of erection or ejaculation were elicited.

4. An elaborated clinical examination was done in all patients with special reference to anemia, skin changes, peripheral nerve thickening, sensory and motor signs (especially ankle reflex) were looked for.

5. Bio-chemical parameters pertaining to renal dysfunction like Blood urea

Serum creatinine Creatinine clearance Serum electrolytes were done for all patients.

Blood hemogram, urine analysis, X-ray chest, and ECG were taken for all these patients.

Supportive evidences like diagnostic ultrasound is taken as a diagnostic tool to assess the size of the kidney as kidneys are contracted in chronic kidney disease.

Normal kidney size ranges from 9 to 12 cm. In chronic medical renal disease, the size of the kidney is usually less than 9 cm. After selecting the patients with reference to inclusion and exclusion criteria, the presence of peripheral nerve dysfunction is assessed in them

1. CLINICALLY by means of motor and sensory symptoms and signs.

2. ELECTROPHYSIOLOGICAL STUDIES — Nerve conduction studies

Clinical features like peripheral sensory loss, pin and needle sensation, burning feet sensation, distal muscle weakness and distal reflex loss are taken as indicators of clinical peripheral nerve dysfunction.

Nerve conduction studies are done in all patients.

A suitable nerve is selected so that it can be stimulated at two points along its course and the response is recorded by using the surface electrodes placed over the muscle, supplied by that particular nerve.

The following nerve conduction studies were performed in all patients on all 4 limbs.

Motor nerve conduction study of Median nerve, ulnar nerve, peroneal nerve Tibial nerve, Sensory conduction study of Median nerve, ulnar nerve and sural nerves were done in all subjects.

In the motor nerve conduction study, the distal latency, amplitude of compound muscle action potential conduction velocity and latency of F waves were studied. In the sensory conduction study the latency and amplitude of sensory action potential were studied.

The following criteria are taken as evidences of peripheral neuropathy

Motor Nerve Conduction Velocity

- Motor nerve conduction velocity < 40 m/sec
- Delayed distal latency
- Fall in amplitude of compound muscle action potential > 30% between proximal and distal stimulation.

Sensory Nerve Conduction Velocity

- Delay in peak latencies.
- Reduced sensory nerve action potential.

Statistical analysis was done with using student's t test, chi square and averages.

The P- values less than or equal to 0.05 ($P \leq 0.05$) were as statistically significant.

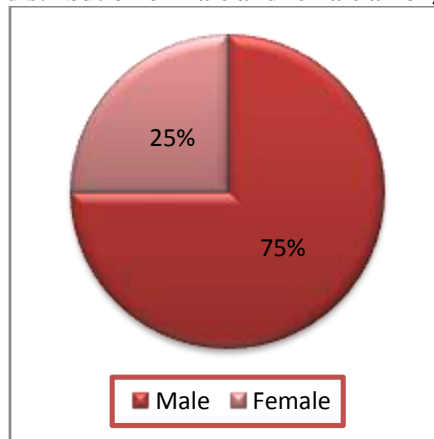
III. Results

Table 1: Percentage distribution of male and female in CKD subjects and affected by PND:

CKD Subjects	Male		Female		Total		χ^2	df	Sig
	No	%	No	%	No	%			
Affected	54	48.6	18	16.3	72	64.9	10.828	1	P<0.001
Not affected	17	15.3	22	19.8	39	35.1			
Total	71	63.9	40	36.1	111	100.0			

The table -1 states, the numbers of persons affected with CKD were 111. Out of 111 assessed, 72 proved to have PND by electro diagnostic study. Among the 72 subjects males and females were 54 and 18 respectively. The peripheral nerve dysfunction was very strongly associated with males ($P < 0.001$).

Fig-1: Percentage distribution of male and female among the PND subjects:



The numbers of patients with peripheral nerve dysfunction were 72. Among them 54 (75%) were male and 18 (25%) were female.

Table-2: Age group wise CKD subjects and affected by peripheral nerve dysfunction

Age Group (years)	Total		Affected	
	No	%	No	%
15 – 24	15	13.5	9	12.5
25 – 34	18	16.2	16	22.2
35 – 44	31	27.9	20	27.8
45 – 54	26	23.4	15	20.8
55 – 64	12	10.8	4	5.6
65 – 74	9	8.2	8	11.1
Total	111	100.0	72	100.0
Mean ±SD	42.6±14.3		41.8±17.7	
Significance	t = 0.32 and P>0.05.			

In the above table-2, among the affected persons 12.5% (9) were in the age group 15 - 24 years, 22.2% (16) persons in the age group 25 - 34 years, 27.8% (20) persons in the age group 35 - 44 years and 20.8% (15) persons in the age group 45 - 54 years, The remaining 5.6% and 11.1% of subjects were in the age group 55 - 64 years and 64 - 74 years respectively. The above table reveals that the affected patients are more in the age group 35 - 44 years. The mean age of the total subjects was 42.6±14.3 years and the affected subjects mean age was 41.8±17.7 years. The difference was not statistically significant (P>0.05).

Fig-2: Age group wise CKD subjects and affected by PND

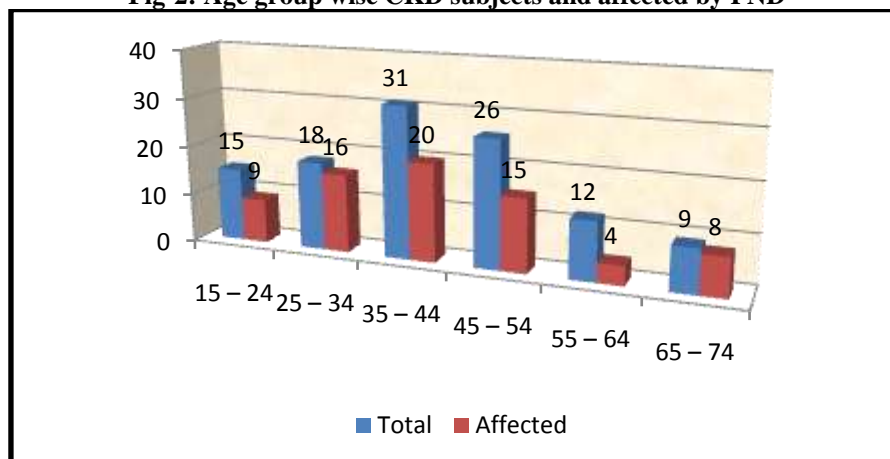


Table -3: No of subjects affected by PND in CKD versus duration of disease

Duration of CKD	P.N. D		No PND		Total		χ^2	df	sig
	No	%	No	%	No	%			
< 3 years	22	19.8	26	23.4	48	43.2	13.441	1	P<0.001
3 + years	50	45.1	13	11.7	63	56.8			
Total	72	64.9	39	35.1	111	100.0			

From this table 3, it is learnt that the number of patients affected with PND was increasing when the duration of CKD was increasing (3+ years). The increasing of duration of PND was statistically very highly significant ($P < 0.001$).

Fig-3: No of subjects affected by PND in CKD versus duration of disease

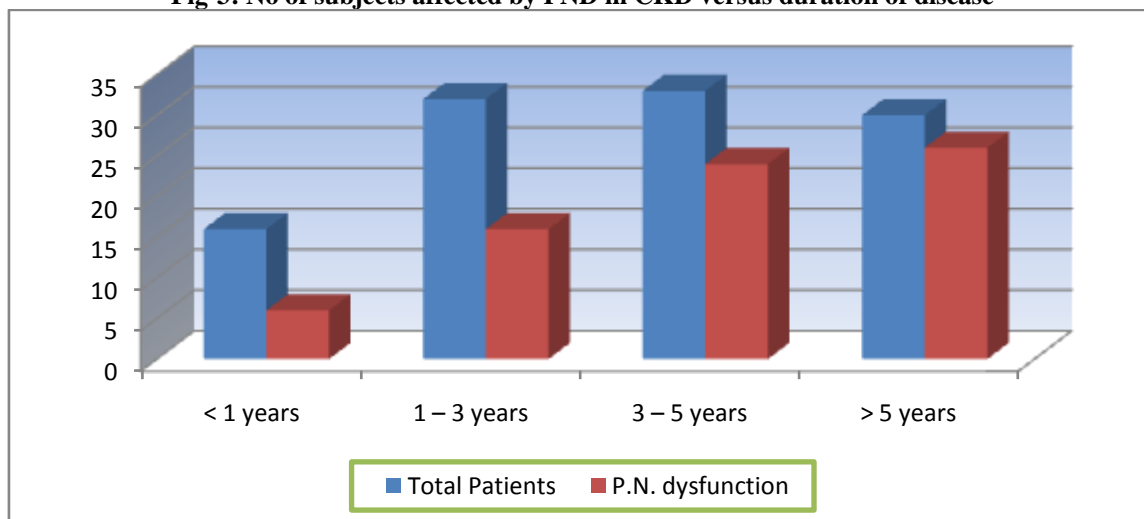


Table 4: Clinical and electro diagnostic characteristics of PND subjects

Clinical	Sensory Motor		Sensory & Motor		Total		χ^2	df	Sig
	No	%	No	%	No	%			
Overt	17	23.6	4	5.6	21	29.2	7.914	1	$P < 0.01$
Sub Clinical	21	29.2	30	41.7	51	70.8			
Total	38	52.8	34	47.2	72	100.0			

The table -4 states that 72 subjects had evidence of peripheral neuropathy by electro diagnostic study. Among them 38(52.8%) subjects revealed sensory motor neuropathy and 34 (47.2%) persons had sensory neuropathy (18) and motor neuropathy (16). It is observed that the commonest type of neuropathy in chronic kidney disease is distal sensory motor neuropathy (52.8%) and the same was strongly associated with sub clinical ($P < 0.01$).

Table -5: Male subjects affected with reference to creatinine clearance

Creatinine clearance ml/mt.	Affected		Not Affected		Total		χ^2	df	Sig
	No	%	No	%	No	%			
< 15	39	54.9	4	5.7	43	60.6	10.877	1	$P < 0.001$
15+	15	21.1	13	18.3	28	39.4			
Total	54	76.0	17	24.0	71	100.0			

The table -5 shows the relationship between the affected males with their level of creatinine clearance. Among the 54(76%) of males affected, 39(54.9%) were creatinine clearance was < 15ml/mt. Among the not affected 17(24%) of males were creatinine clearance was 15 + ml/mt. The Males were affected when the creatinine clearance was statistically very strongly significantly associated with <15 ml/mt ($P < 0.001$).

Table -6: Female subjects affected with reference to creatinine clearance:

Creatinine clearance ml/mt.	Affected		Not Affected		Total		χ^2	df	Sig
	No	%	No	%	No	%			
< 15	12	30.0	20	50.0	32	80.0	2.279	1	$P > 0.05$
15+	6	15.0	2	5.0	8	20.0			
Total	18	45.0	22	55.0	40	100.0			

The table -6 states the relationship between the affected females with their level of creatinine clearance. Among the 18(45%) females affected, 12(30%) were creatinine clearance was < 15ml/mt. Among the not affected 22(55%) of females 20(50%) were creatinine clearance was <15 ml/mt. The females were affected by the creatinine clearance was not statistically significantly associated with either <15 ml/mt or 15+ ml/mt ($P > 0.05$).

IV. Discussion

In this study the peripheral neuropathy dysfunction was strongly associated with CKD in respect of males ($P < 0.001$) and the females were not like males. Similar observations were made by The mean age of PND subjects was equal with the mean age of CKD subjects ($P > 0.05$). The duration of CKD was increasing, the prevalence of PND was significantly increasing ($P < 0.001$). The sensory motor was strongly associated with Overt and the sub clinical observation was strongly associated with sensory as well as motor ($P < 0.01$). The affected male subjects were strongly associated with < 15 ml/mt and not affected were very strongly associated with $15+$ ml/mt creatinine ($P < 0.001$). But the females affected and not affected were not associated with either category of creatinine ($P > 0.05$).

Peripheral neuropathy is one of the common complications in chronic kidney disease (CKD). Recent epidemiological studies of CKD shown that it is more common than that previously thought. Distal symmetrical sensory motor neuropathy is the common type of peripheral neuropathy observed in CKD patients. There is a male prediction in the prevalence of peripheral neuropathy in CKD when the creatinine clearance is < 15 ml/minuet.

By H.K. Agarwal's study the incidence of peripheral neuropathy in chronic kidney disease was 70% and the incidence overt neuropathy and subclinical neuropathy was 8% and 62% respectively.

By the Tadhushadhana's study the references incidence of peripheral neuropathy was 65%.

In this study the incidence of peripheral neuropathy in chronic kidney disease was 64.8% and the incidence of overt and subclinical neuropathy was 18.9% and 45.9% respectively.

V. Conclusion

Our study results suggest that clinical examination and nerve conduction study are very important in detecting peripheral neuropathy in chronic kidney disease patients and can also detects the neuropathy in largely asymptomatic patients. Incidence of peripheral neuropathy is having linear relationship with severity and duration of renal failure.

References

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