VOLUME-8, ISSUE-4, APRIL-2019 • PRINT ISSN No 2277 - 8160

Original Research Paper

Neurology

CLINICAL, ETIOLOGICAL AND BIOCHEMICAL PROFILE OF A HYPOKALEMIC PARALYSIS PATIENTS – A STUDY FROM BURDWAN MEDICAL COLLEGE, WEST BENGAL

Annada. Prasad. Bhattacharya	DM Neurology, Department of Neurology Burdwan Medical College
Hilal Ahmad Ganaie*	DM Neurology, Fellow ship in stroke and Neurointervention, Formerly DMPDT, Department of Neurology Burdwan medical College., Burdwan west Bengal *Corresponding Author
Javaid Ahmad Bhat	DM Endocrinology, Sher -i- kashmir institute of medical sciences srinagar j&k.
Sandip Paul	DM Neurology, Professor Department of Neurology, Calcutta Medical College, Kolkata, West Bengal

ABSTRACT

Background:- Hypokalemic Paralysis (HOP) is a channelopathy (typically involving voltage gated calcium or sodium channels) due to mutation of CACNA1S or SCN4A genes and accounts for large number of cases of acute flaccid paralysis. If properly diagnosed and treated, patients recover without much clinical sequlae.

Objectives:- To study the varied clinical profile, etiological factors and biochemical abnormalities of subjects presenting with Hypokalemic paralysis.

Result:- From 1st January 2013 to December 2014, 50 cases in the age group range 3 - 73 years presented with periodic paralysis. The study group comprised of both males and females in the ratio of M:F-2.8:1 The mean age of presentation of studied subjects was 36.28 ±15.90 (15 - 73 years). The highest cases were found in the age groups: 21 - 30 years(28%) & 41 -50 (28%) . Male and Female ratio 2.81:1. The clinical presentation was in the form of quadriparesis-42, paraparesis-5, hemiparesis -2 and isolated neck muscle weakness-1. Out of 30 idiopathic hypokalemic periodic paralysis cases ,2 cases were having positive family history. Among the 18 secondary HOP cases etiology varied from renal tubular acidosis-8, Gitelman Syndrome-2, Conn's syndrome-2, 2 cases of thyrotoxic periodic palsy-2, two cases of alcohol induce hypokalaemia-2, one case is hypothyroid induced-1), another was iatrogenic-1.

Conclusion:- We conclude that HOPP is an important cause of acute flaccid paralysis and early recognition and prompt management of this condition will give gratifying result and prevent further attacks in some cases

KEYWORDS : Periodic paralysis, hypokalemia, primary, secondary.

INTRODUCTION

Periodic paralysis (PP) is a disease of skeletal muscle in which patients experience episodic attacks of flaccid muscle weakness of variable duration and severity. Most of the patients with (PP) present with proximal weakness, normal sensation, diminished stretch reflexes during attacks[1,2]. Periodic paralysis is classified according to serum potassium during attacks into hypokalemic periodic paralysis (HOPP) normokalaemic periodic paralysis (NPP) and hyperkalemic periodic paralysis (HYPP). Though this classification is still used clinically but has now been supplemented by the newer molecular genetics classification.[3,4] Hypokalemia is defined as serum K^+ concentration of less than 3.5mmol/lit (normal 3.6-5.0 mmol /lit).[5] Most of the cases are due to familial or primary HOPP with underlying genetic basis. Two genes are known to be associated with hypokalemic periodic paralysis (HOPP), calcium channel gene (CACNA1S) accounting for approximately 55-70% of HOPP type 1 and sodium channel gene (SCN4A) accounting for 8-10% of HOPP type 2[1,3]. Symptoms of primary hypokalemic paralysis (PHOP) typically begin in the first or second decade, attack of flaccid paralysis usually occur on awakening in the night or in the early morning. Weakness is usually generalized, rarely being focal, usually sparing facial and respiratory muscles, and lasting for hours (occasionally days) with gradual resolution. Frequency of individual attacks can vary from daily to few episodes in a life time, Attacks often decrease spontaneously or resolute in frequency after age of 40.[6] It is now known that in both genetic and acquired forms of periodic paralysis, it is the dysfunction of voltage-gated ion channels which is the underlying pathophysiology.[7]

Although the clinical manifestation may be similar in both primary and secondary hypokalemic paralysis (SHOP), the long term management of different types of hypokalemic paralysis (HOP) is different and therefore, it is imperative for physicians to be aware about the causes of hypokalemic paralysis. The treatment of acute attacks is aimed at restoring serum potassium levels to the normal range. Long term management differs in secondary hypokalemic paralysis depending on the underlying cause. The present study has been being undertaken to determine the etiology of hypokalemic paralysis, its varied clinical presentations, biochemical correlation and the clinical outcome after potassium replacement therapy of this fairly treatable but potentially fatal metabolic disease.

MATERIAL AND METHODS

This present study had been conducted in Burdwan Medical College in the Dept. of Neurology. This is a prospective single center study done over a period of 2 yrs from first January 2013 to Dec 2014 after ethical committee clearance. A total of 50 consecutive patients of Hypokalamic paralysis were recruited in this study. Patient who presented with acute onset generalized or focal weakness was evaluated. Patients with upper motor weakness were excluded so we're Patient's presenting with acute flaccid weakness secondary to nerve diseases, neuromuscular junction disorder, and acute spinal cord diseases after evidence from clinical , electrophysiolical or imaging were excluded from the study. Patients of hypokalamic paralysis who were admitted in the department of neurology were selected after clinical and biochemical diagnosis was confirmed. A written informed consent was taken from the participants included in the study. Inclusion criteria included those patients who presented with acute onset weakness involving one or more limbs secondary to hypokalemia (potassium less than 3.5) and improvement in weakness following potassium replacement.

The clinical data collected for HOP include age, sex, ethnic origin, duration of illness, number of episodes of acute muscular weakness, time to improve, precipitating factor, family history and for secondary cause history of renal stone, bone pain, dry eye, fracture, thyroid disease, parotid and lacrmial gland enlargement. Clinical examination with special emphasis on blood pressure and detailed neurological examination were done including muscle power evaluation based on MRC Scale. The following biochemical parameters were estimated: serum sodium, potassium, bicarbonate, chloride, creatine, calcium, phosphate, magnesium, albumin, and globulin. 24 hour urinary calcium, phosphate, potassium and creatine were also carried out in selected patients.

All the patients under went thyroid function test, Arterial blood gas analysis and 12 lead electrocardiogram (ECG). Serum aldosterone, plasma renin levels and CT of the adrenal gland were done in selected group of patients. The clinical and laboratory data of these patients were analyzed after taking proper consent

RESULTS

A total of fifty cases who presented with Hypokalamic paralysis were recruited in the study. The mean age of presentation of studied subjects was is 36.28 ± 15.90 (15-73). The highest cases were found in the age groups: 21 - 30 years(28%) & 41 -50 (28%) followed by 31 - 40 years (16%) and 11 - 20 years (12%). Male constitutes 74% (n=37 cases), and female constitutes 26% (n=13 cases). Out of 50 cases 12 % (n=6) were tribal's where rest 88% were non tribal. District wise distribution of the case is given in the Figure 1. There was varied clinical presentation with, 84% (n=42) cases presented with classic acute onset quadriparesis with or without neck muscle weakness. Eight cases had atypical presentation with 10% (n=5) cases had paraparetic type of weakness, 2 cases had hemiparetic presentation and one case presented with isolated neck muscle weakness without any limb weakness. None of case in our series had the ocular or respiratory or sphincter problems. Out of 50 HOP, 32 primary HOP and 18 were secondary HOP. Details of diagnosis of 50 subjects is Given in Table 1.

Figure 1: Showing district wise distribution of Hypokalemic cases

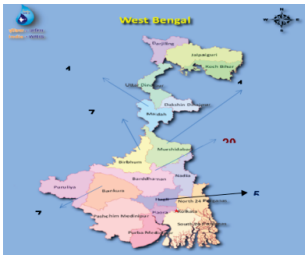

Table 1: Final diagnosis of the hypokalemic Cases.(n=50)

Diagnosis	n (%)
Sporadic hypokalemic paralysis	30 (60%)
Familial hypokalemic paralysis	2 (4%)
Renal tubular acidosis	8 (16%)
Gitelman's syndrome	2 (4%)
Thyrotoxic paralysis	2 (4%)
Conn's syndrome	2 (4%)
Alcohol induced	2 (4%)
Hypothyroid paralysis	1 (2%)
Iatrogenic	1 (2%)

The weakness among the studied subjects was precipitated by heavy physical exertion in 50% of cases and 14 % had excessive carbohydrate diet and % 4% were precipitated by heavy alcohol intake. Among the 25 cases who were precipitated by heavy exertion, 15 patients also had excessive carbohydrate diet.[Table 2] The maximum number of cases is found in summer season (April-June) 22 cases (44%) followed by Monsoon (July- September) 28% then Winter Season (December-March) 24% of the cases. Among the 50 cases , 10 cases (20%) had single attack, 31 cases (62%) 2-5 times attack and 9 cases (18%) 5 or more attacks. Electrocardiography in 20% cases are normal, prominent U Wave 46% of the cases, T Wave flattening 12% if the cases, T Wave inversion 10% of the cases, ST Depression 2% of cases, Prolonged PR Interval 6% of the cases, Sinus Bradycardia 2% of the cases, Atrial Fibrillation 2% of the cases. Among the 50 cases of periodic paralysis deep tendon reflexes were diminished 28 cases (56%), absent 18 cases (35%) and normal in 4 cases (8%).

The severity of the weakness of subjects included in the study (primary HOP and secondary HOP) is in Table 3. Lower limbs were weaker than upper limbs in patients having quadreparatic weakness. Secondary HOP cases required significantly prolonged time for recovery as compared to the primary HOP (p=0.016). Secondary HOP also required more potassium requirements for recovery as compared to Primary HOP. However there is no significant correlation of severity of weaknees p=0.53(determined by MRC grading of power in proximal muscles), number of weakness attacks (p=0.66) and serum CPK levels (p=0.36) between primary HOP and secondary HOP [Table 3] The severity of weakness of proximal muscles measured in MRC grading showed a significant correlation with serum potassium levels (p=0.010) but did not show any correlation with CPK Levels (P=0.86) [Table 4] . The serum potassium concentration did not have significant correlation with CPK levels p= [Table 5]

Table 2: Showing gender distribution and various precipitating factors between Primary and Secondary cases

		Diagnosis		Total	P Value
		Primary Hypokalamiparalysis	Secondary Hypokalemic paralysis		
Sex	Male	25	12	37	0.375
	Female	7	6	13	
Precipitating factor	Heavy Work with excess carbohydrate diet	10	2	25	0.209
	Heavy Work with out carbohydrate diet	12	1	13	0.032
	Excess Carbohydrate diet only	**5**	**0**	**5**	0.201
	Spontaneous	5	13 (72.22)	22 (44)	0.00006
	Alcohol	0 (0)	2 (11.11)	2 (4)	0.240

Table 3: Showing severity of weakness of proximal muscle (MRC Grading) Number of attacks, time taken to improve and serum CPK levels

		Primary Hypokalemic Paralysis	Secondary Hypokalemic Paralysis	Total	P Value
Power MRC	O/5 and 1/5	6 (33.3)	6 (33.3)	12	0.53
	2/5	10 (43.8)	7 (38.9)	17	
	3/5	11 (34.4)	2 (11.1)	13	
	4/5 and above	5 (12.5)	3 (16.7)	8	
Number of Attacks	Single	8 (25)	2 (11.11)	10 (20)	0.66
	,<5	18 (56.25)	13 (72.22)	31 (62)	
	> 5	6 (18.75)	3 (16.67)	9 (18)	
Time taken to improve (days)	<2 days	18 (56.25)	2 (11.11)	20 (40)	0.018
	2 to 5	14 (43.75)	14 (77.78)	28 (56)	
	> 5days	0 (0)	2 (11.11)	2 (4)	
Serum CPK	< 500	10	4	14	0.36
	500-1000	14	6	20	
	> 1000	8	8	16	
Total	32 (100)	18 (100)	50 (100)		

Table 4: Showing relation of severity of weakness with CPK levels and serum Potassium levels

		Power (MRC) proximal muscles			Total	P
		0 and 1	2 and 3	4 & above		
CPK Levels	<500	2	10	2	14	0.860
	500-1000	4	12	4	20	
	>1000	6	8	2	16	
Serum Potassium	>2.5	0	8	6	14	0.010
	1.5-2.5	6	18	2	26	
	< 1.5	6	4	0	10	

Total	12	30	8	50		

Table 5: Relation of CPK and serum Potassium in Hypokalemic periodic paralysis Patients (n=50)

			CPK levels			Total	p
			<500	500-1000	>1000		
Serum Potassium levels	>2.5	n	10	6	2	18	0.80
	1.5-2.5	n	12	11	5	28	
	< 1.5	n	1	2	1	4	
Total		n	23	19	8	48	

A total 18 patients (36 %) in this study had secondary and potentially reversible causes of HOP. The detail of the diagnosis in secondary is given in Table 1. A detailed work up for secondary cause was undertaken in these patients. Renal tubular acidosis had significantly lower serum bicarbonate and higher levels of chloride as compared with those who had primary hyperaldosterism (n=2), although potassium values were similar. All patients with primary hyperaldosterism had hypertension at presentation. A single case of Gitleman Syndrome who presented with severe hypokalemic, hypomagnesaemia, hypophosphataemia and hypocalciura was detected. All patients had recovery with potassium replacement therapy or spontaneously. Primary HOP were treated with acetazolamide with no further recurrence of symptoms during next six month period of follow up. And secondary HOPP the underlying cause was managed with no further recurrence.

DISCUSSION

Hypokalemic periodic paralysis is the best known form of periodic paralysis and is characterized by hypokalemia occurring during the episode of muscle weakness. In the present hospital based prospective study, 50 cases of HOP were detected over a period of 24 months. In one of the largest study on HOP from Taiwan by Lin et al. a total of 97 cases of hypokalemic paralysis were reported over a period of 10 years.[8] Various series of HOP cases has been reported from India also. Agarwal et al[9] from Central India had reported 40 cases of HOPP in 23 years, and Arya et al. a total of 22 cases of HOP were reported over 30 years.[10] In retrospective study from South India by Rao et al., 31 patients were detected over a period of 6 years.[11] A recent prospective study from North India by Maurya and colleagues, reported 30 patients of HOP over a period of 3 years.[12] Our study has significantly higher number of cases (n=50) over a short duration of time in comparison to previous studies from India, which indicates probably we see a higher number of cases of HPP in comparison to other parts of the country. Similarly Biranchi Narayan et al[13] also reported 50 cases hypokalemic from western Odessa in a span of 2 yrs the same geographic area.

The male: female ratio in our study was 2.84:1, earlier studies has also shown a male preponderance in case of HOPP. In the study from Taiwan the male to female ratio was 77:20, however, Indian studies have also shown a male preponderance of the disease with ratio as high as 9:1.[8,12] In the study by Ghosh A et al. from Orissa, male: female ratio was 2.95:1.[14,] K Jeganniwas et al. from Chennai, 3:1.[15]In our study the mean age was 36.28±15.90 years with an age range of 03-73 years with maximum number of cases in two age groups 21-30 years& 41-50 years which were consistent with most of the most of the national and international studies.[8,14,16,17]In our study cases coming from six district of West Bengal, where 29 cases (58%) coming from Burdwan district, 7 case from Birbhum, 7 cases from Bankura, 5cases from Hooghly. Though it is hospital based study, actual representation of population cannot be possible but long duration of summer , poor water intake, excessive humidity , heavy carbohydrate diet , manual work patterns are probably cause of most of the cases in this particular geographic part of southern West Bengal.

In our study 36% of patients with hypokalemic paralysis had a secondary cause for their condition. Primary HP occurred in 64% of patients out of which 60% of total cases were sporadic periodic paralysis while 4% where FPP. In our study, among the 18 total secondary cases, RTA emerged as the most common cause founded in 44%, Thyrotoxic paralysis was the cause in 11.1% alcoholism in 11.1% , hypothyroidism in 5.6% , Primary hyperaldosteronism in 11.1 Hypokalemia can be due to a number of aetiological factors. In the large series reported by Lin et al., etiologies included thyrotoxic paralysis in 40.2%, sporadic in 29.8%, familial in 2.1%, primary hyperaldosteronism in 6.2%, RTA, Bartter and Gitelman's syndrome(GS) in 6.2%, diuretic use in 3.1%, and ingestion of toluene blue in 3.1% of patients.[8] Overall 68% had secondary paralysis. In the study by Rao et al., secondary hypokalemic paralysis was present in 93.6% of patients.[11] HOP was due to hyperaldosteronism in 42% of patients, RTA in 42%, Thyrotoxicosis in 6.4%, Gitelman's syndrome in 3.2%, and sporadic paralysis in 6.4% of patients. The difference in the aetiology of hypokalemic paralysis and a high percentage of secondary cases in this study compared to our study may be due to a difference in genetics makeup , occupation and environment.

Our findings were quite different from those of other Indian series of 22 cases reported by Arya et al. Twelve out of 22 (54%) cases in this study had secondary HPP due to gastroenteritis, thyrotoxicosis, and diuretic use.[10] In the study by Maurya et al. Primary HOP occurred in 56.7% of patients and Secondary hypokalemic paralysis in 43.3% patients. In secondary causes RTA and Gitelman's syndrome was the cause in 13.3% and thyrotoxicosis in 16.7% of patients.[12] Dhall et al. reported 14 cases of hypokalemic periodic paralysis, of which 5 were of primary type and 9 cases were of secondary HPP, out of secondary HPP 4 were due to thyrotoxicosis, and 5 were due to gastrointestinal potassium loss.[18] Agarwal etal. had 40cases of HPP of which14 cases were of sporadic primary variety, 3 were of familial periodic paralysis and 23 cases of secondary HPP thyrotoxicosis-5; gastrointestinal cause-6, barium carbonate toxicity-10, distal RTA-2).[19]

There was a seasonal variation in the incidence of hypokalemic attacks, highest numbers of cases (44%) were symptomatic during the summer season in the month from April to June, when the average temperature in this region ranges from 20-40°C. However these patients did not have any clinical evidence of dehydration on admission to hospital. This is consistent with earlier Indian study which has also shown high prevalence of cases of hypokalemic paralysis in the summer month. Ghosh A et al. from Orissa, showed that there was a marked seasonal variation with maximum cases presenting in months of May and June (55.48%, 31.43% and 53.01% of cases in 2005, 2006 and 2007respectively).[6]M Murmu et al. from Orissa showed that maximum number of cases (37.05%) has been admitted in the month of May to June'01.[21] So, our study strongly supports other previous Indian studies. In our study 42 cases (84%) are quadreparatic with neck muscle weakness presentation, 5 cases (10%) of paraparetic presentation, 2 cases (4%) of hemiparetic presentation and 1 of isolated case presented isolated neck muscle weakness. our study we found few atypical presentation of the cases (hemiparesis, paraparesis or isolated neck muscle weakness). This atypical presentation in may due to variable clinical presentation because of early institution of therapy before full expression, genetically predetermine muscle affection.

In our study TPP was the cause in 4% of all cases of PP. Asians are more affected with this condition, with one study showing that Polynesians were at 159-fold higher risk compared to white Europeans.[18] Lin et al. study had TPP in 40.2% as the aetiology among all cases of HOP .[18]In our study RTA was one of the leading cause of secondary hypokalemic paralysis and observed in 44.4% (n=8). A study from Kashmir, has reported 21 cases of hypokalemic paralysis secondary to RTA over a period of 8 years.[23] Most of the cases in this study had RTA of sporadic nature. In the South Indian study RTA was the cause in 42% cases of HPP.[11] Gitelman's syndrome which were diagnosed in 2 cases of HOP. Gitelman's syndrome has been reported in earlier Indian studies with a varying incidence rate ranging from 3.2% to 13.3%.[11,12] One of the patients with Gitelman's syndrome (GS) presented with tetany with quadriparesis. The tetany may be attributable to exacerbation of alkalosis and consequent low ionized plasma calcium in presence of hypomagnesaemia.

In our series, two patients 11.1% of total secondary PP had primary hyperaldosteronism as the secondary cause of HOP. HOP as a presentation of primary hyperaldosteronism is commonly reported among the oriental races.[24,25] in a series of 50 patients with primary hyperaldosteronism from Taiwan, 42% presented with periodic paralysis, although all 50 had hypokalaemia.[25] one of our cases was detected as HOP secondary to hypothyroidism. There are rare case reports of association of hypokalemic paralysis with hypothyroidsism.[26] This case had onset of illness after 40 years of age which makes the primary cause of HPP less likely, also the non-recurrence of episodes of paralysis after thyroid replacement during short follow-up favors this association.

In a recent study from same geographic area (Midnapur West Bengal) in 200 cases of Hypokalamic paresis Probable GS topped the list involving 28% individuals of the entire cohort while probable Barter syndrome, distal RTA, and HOP were diagnosed in 20%, 22%, and 19% cases, respectively. In this study rural tribal population was (61%) and age group of 30–40 years suffered the most (48%) with concentration of cases in hot and humid summer months[33]

In our study multiple attacks are more in secondary HOP cases though statistically insignificant (p=3.446). Ghosh A et al. from Orissa in their study showed that recurrence of attack was seen in 127 (37.46%) patients.[6] S Phanidhar et al. from Andhra Pradesh showed that 15/21 (72%) patients presented for the first time and remaining had history of similar attacks in the past.[8] In another study by K Jeganniwas et al. from Chennai, revealed that among 40 cases of HPP 40% of patients had recurrence.[7] So our study is consistent with previous Indian studies. The muscle weakness was more pronounced in the secondary group compared to the primary group which is however statistically insignificant (p=0.53). One of the earlier study has also shown similar results.[12] In our study, most of the cases the severity of weakness in the lower limbs was either greater than or equal to upper limbs and the overall difference of power between lower limbs and upper limbs was statistically highly significant (p= 0.004). Other Indian studies have also shown similarfindings.[10]

One patient in our study had predominant weakness of the extensors of the neck presented with neck droop, one case of Gitelman's syndrome presented with features of tetany with quadriparesis and five cases presented with paraparesis and two cases presented with hemiparesis which does not support any earlier studies. This different presentation may be due to asymmetric early presentation or weakness of the muscle by the particular susceptible gene. Atypical presentation in the form of bladder involvement, early neck muscle weakness and finger drop has been reported in earlier Indianstudies.[16,27]

In our study, the serum potassium concentration in HPP (2.38$\pm$0.45 meq/L,mean $\pm$ SD -) than in those with primary HPP (2.41$\pm$0.63 meq/L,mean $\pm$ SD,) though the difference was statistically insignificant (p=0.855). In another study by Lin et al., also there was no significant difference in potassium values between patients with primary and secondary hypokalemic paralysis.[8] But in the study from India by Maurya and colleagues, the serum potassium concentrations were significantly lower in patients with secondary hypokalemic paralysis than in those with primary hypokalemic paralysis.[12] Ghosh A et al. found among 423 cases of HPP the range of serum potassium varied from 1.0 to 3.4 meq/l (average - 2.2 meq/l)[14]. K Jeganniwas et al[15]. found the mean serum potassium was 2.5 Meq/L. S Phanidhar et al[28]. found mean potassium level was 1.7 mEq/L.

In our study, the elevation of serum creatine kinase (CPK) in 76% of the cases is an indirect evidence of damage to muscle membrane. This has also been infrequently reported in earlier Indian studies.[30] Serum CPK was also significantly higher (p=0.009) in the secondary group (900.67 U/L$\pm$673.37U/L) compared to the primary group (507.84 U/L $\pm$345.91U/L). It is postulated that hypokalemia causes muscle ischemia, resulting in a rise in serum CPK. Higher than normal levels of this enzyme during the recovery phase can been used to identify symptomatic patients in whom serum potassium becomes normal after or during hypokalemic paralysis. In our primary cases few patients having high normal CPK level which have recurrent episodes and poor follow-up. Most of the study shows profound hypokalemia can even lead to rhabdomyolysis. Hypokalemia-induced muscle ischemia leading to an alteration in the internal milieu of the muscle fiber has been proposed to be a mechanism responsible for muscle damage.[29,31,32]

In the present study, in, U wave was seen in 46% cases, T wave flattening is seen in 12% cases, T wave inversion in 10% cases, ST segment depression in 2% cases, prolonged PR interval in 6% cases, atrial fibrillation 2% and normal in 20% cases. Our findings in electrocardiogram are concordant with previous studies.[32,33] Ghosh A et al. [14] K Jeganniwas et al[12] and M Murmu et al[21]. found similar ECG changes .[19] There was no co-relation between serum potassium and ECG changes. S Phanidhar et al.[28] found T wave flattening with U waves in 18/21 (85.8%) and ventricular bigeminy in 3/21 (14.2%).[8] Jeng-Chuan Shiang et al. observed relative tachycardia, first-degree AV block, and prominent U waves on ECG monitoring in their study onTPP.[28]

In this study, recovery with potassium replacement therapy was seen in most of cases (96%) and two secondary cases (RTA) expired due to late presentation and delay in diagnosis. The secondary group needed longer to recover compared to the patients with primary HPP and the difference in recovery time was found to be statistically significant (p=0.003). This is consistent with previous studies.[8,12] The patients with secondary hypokalemic paralysis had a significantly negative total body potassium balance, where as in primary hypokalemic paralysis it was associated with an intracellular shift of potassium; therefore, the patients with primary hypokalemic paralysis needed smaller amounts of potassium and had early recovery compared to the secondary group. Considering other similar studies by Patra S from Midnapur (n= 200), Mahapatra BM from Odisha (n=50 cases) , kayal et al (n =39) and our study,(n=50) Eastern India represents as a high burden of hypokalemic paralysis than rest of the country.

CONCLUSION:

Our study has shown large number of cases in a short period of time, which may reflect higher prevalence of this condition in this particular region. We have also seen a wide variety of different presentation (like paraparesis and hemiparesis) in comparison to previous Indian studies. Our study also highlights some of the unusual causes of HOP like hypothyroidism; alcohol induced which has been previously reported only in isolated case reports.

Finally we can conclude that HOP is an important cause of acute flaccid paralysis and early recognition and prompt management of this condition will give gratifying result and prevent further attacks in some cases.

LIMITATION OF ARTICLE:

This study is hospital based study. So actual data in the community regarding hypokalemia may not reflect the true picture. Also in hospital based study there is always a chance of bias i. e. the subjects may not be the ideal representative of the population. Epidemiological studies required community based study for unbiased estimate. Since predominant cases are idiopathic and it needs further genetic study to determine any genetic abnormalities.

REFERENCES

1. Walter G. Bradley, Robert B. Daroff, Gerald M. Fenichel, Joseph Jankovic, Neurology in clinical Practice 2008; 5th Edition, Vol II:1803-1804.
2. Fontaine B, Vale SJ, Jurkat RK, Reboul J, Plassart E, Rime CS, Elbaz A, Heine R, Guimaraes J, Weissenbach J, et al. Mapping of the hypokalaemic periodic paralysis (HypoPP) locus to chromosome 1 q31-32 in three European families. Nat Genet 1994; 6(3) : 267-72
3. Miller TM, Dias da Silva MR, Miller HA, Kwiccinski H, Mendell JR, Tawil R, Mc Manis P, Griggs RC, Angelini C, Servidei S. Correlating phenotype and genotype in the periodic paralyses. Neurology 2004; 63 : 1647-55.

4. Fouad G, Dalakas M, Servidei S, et al. Genotype – phenotype correlations of DHP receptor alpha 1-subunit gene mutations causing hypokalemic periodic paralysis. Neuromuscul Disord 1997; 7 : 33-8
5. Longo, Fanci Kasper, Hauser, Jameson, Loscalzo, Harison's Principles of Internal Medicine, 18th Edition; Vol I:351-52.
6. Links TP, Zwarts MJ, Wilmink JT, Molenaar WM, Oosterhuis HJ. Permanent muscle weakness in familial hypokalaemic periodic paralysis. Clinical, radiological and pathological aspects. Brain 1990; 113 : 1873-89
7. Mathews E, Labrum R, Sweeney MG, et al. Voltage sensor charge loss accounts for most cases of hypokalemic periodic paralysis. Neurology 2009; 72 : 1544-7
8. Lin SH ,Lin YF ,Halperin M.Hypokalemia and paralysis. QJM 2001;94:133-9
9. Agrawal AK, Gupta S, Wali M, Sangla KS. Hypokalaemic paralysis, PC Manoria, Medicine Update (APICON – 96) (General Medicine), 140 Dynamic Centre, M. P. Nagar, Zone - 1, Dristi Offset, Bhopal M. P., VI (PartIV):260-5
10. Arya SN. Periodic paralysis. JIACM 2002 ;3:374–82
11. Rao N, John M, Thomas N, et al. Aetiological, clinical and metabolic profile of hypokalaemic periodic paralysis in adults: a single-centre experience. Natl Med J India 2006;19:246-9
12. Maurya PK, Kalita J, Misra UK. Spectrum of hypokalaemic periodic paralysis in a tertiary care centre in India. Postgrad Med J 2010;86:692-5
13. Mohapatra BN, Lenka SK, Acharya M, Majhi C, Oram G, Tudu KM, et al. Clinical and aetiological spectrum of hypokalemic flaccid paralysis in Western Odisha. J Assoc Physicians India 2016;64:52-8.
14. Ghosh A, Mohapatra MK, Karua PC, Murmu M, Kar A; VSS Medical College, Burla,Orissa Profile of Hypokalaemic Periodic Paralysis – A Prospective Study; JAPI 2009, Neurology Feb-8
15. K Jeganniwas, K Mayilananthi, Sripriya V Haridoss, K Purusothaman, SPThirukmalaikolundu;Clinical Profile of Hypokalemic Paralysis; http://www.japi.org/july_2008/endocrine.htm/20
16. Talbott J H :Periodicparalysis: Aclinicalsyndrome .Medicine(Baltimore)20:85,1941
17. Agarwal A. K. Medicine update 2009, Association of Physician of India ,part I, p4
18. Dhall A, Sharma LR, Bakshi AK et al. Hypokalaemic paralysis – A clinical study. J Assoc physicians India1994;42:1028.
19. Agrawal AK, Gupta S, Wali M, Sangla KS . Hypokalaemic paralysis, PC Manoria, Medicine Update (APICON – 96) (General Medicine), 140 Dynamic Centre, M. P. Nagar, Zone - 1, Dristi Offset, Bhopal M. P., VI (PartIV):260-5
20. Pal PK, Vengamma B. Atypical Neurological Manifestations of Hypokalemia. Ann IndAcadNeurol2004;7:375-80
21. Clinicolaboratory Profile of Hypokalemic Paralysis in Western Orissa; M Murmu, B Pradhan, NT Minz, S Das; VSS Medical College, Burla
22. Pal S, Sanyal D. Jaw muscle weakness:a differential indicator of neuromuscular weakness--preliminary observations: Muscle Nerve. 2011 Jun;43(6):807-1.
23. Koul PA, Saleem SM, Bhat D. Sporadic distal renal tubular acidosis and periodic hypokalemic paralysis in Kashmir. J Intern Med1993;233:463–6
24. Ma JTC, Wang C, Lam KSL, et al. Fifty cases of primary hyperaldosteronism in Hong Kong Chinese with a high frequency of periodic paralysis. Evaluation of techniques of tumor localization. Q J Med1986;61:1021–37
25. HuangYY, BrendRH,andTsaiJS.Paralyticmyopathy-aleadingclinicalpresentationfor primary aldosteronism in Taiwan. J Clin Endocrinol Metab1996;81:4038-41
26. Kinoshita I1, Usa T, Satoh A, Tsujihata M.. A case of hypothyroidism associated with hypokalemic periodic paralysis Rinsho Shinkeigaku 1990;30(1):100-2
27. Kayal AK ,GoswamiM, DasM, Jain R, clinical and biochemical spectrum of hypokalemic paralysis in North East India..Ann Indian Acad Neurology 2013;16:211-17
28. S Phanidhar, Vijaya Raghava Rao, Sivaramakrishna, Manohar Hypokalemic Periodic Paralysis - A Clinical Profile;;Gandhi Medical College, Gandhi Hospital, Andhra Pradesh JAPI,2002
29. Jeng-ChuanShiang,Chih-JenCheng,Ming-KaiTsai,Yi-JenHung,Yu-JueiHsu,Sung-Sen Yang, Shi-Jye Chu, and Shih-Hua Lin. Therapeutic analysis in Chinese patients with thyrotoxic periodicparalysis over 6 year. EurJEndocrinol.2009;161:911-916
30. Pal PK, Vengamma B. Atypical Neurological Manifestations of Hypokalemia. Ann Ind Acad Neurol. 2004;7:375-80
31. Wolf P, Griffiths J, Koett J, Howell J. The presence of serum creatine kinase 2 (MB) in hypokalemic familial periodic paralysis. Enzyme.1979;24:197–9.
32. WiggersP ,Nørregaard-HK.. Myoglobin, creatinekinase and creatinekinase subunit-beta in serum from patients and relatives with hypokaliaemic familial periodic paralysis. Acta Neurol Scand.1985;71:69–72.
33. Patra S, Chakraborty P P, Biswas S N, Barman H. Etiological search and epidemiological profile in patients presenting with hypokalemic paresis:An observational study. Indian journal of Endocrinology and Metabolism 2018:22;397-404