



THYROID PROFILE IN HYPOKALEMIC PARALYSIS

Dr. P. Kesava Rao	Associate Professor, Department of General Medicine, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, Andhra Pradesh 534005.
Dr. S. Vidya Sagar*	Post Graduate, Department of General Medicine, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, Andhra Pradesh 534005. *Corresponding Author
Dr. G. Swarnalatha Devi	Professor & HOD, Department of General Medicine, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, Andhra Pradesh 534005.

ABSTRACT

INTRODUCTION: Hypokalemic paralysis is a form of metabolic myopathy, which represents a Heterogeneous group of disorder characterized by Hypokalemia, acute flaccid paralysis and potentially fatal episodes of muscle weakness through the involvement of the respiratory muscles, and life threatening cardiac arrhythmias. Thyrotoxicosis is the most common cause of secondary Hypokalemic paralysis. Thyrotoxic Hypokalemic paralysis is common in the Asian population.

MATERIALS AND METHODS: It is a cross sectional study. Our plan is to see the association of thyroid abnormalities in Hypokalemic paralysis patients. Patients of Hypokalemic paralysis confirmed by clinical history, examination and laboratory investigations were included in the study done at Alluri Sitaramaraju Academy of Medical sciences from June 2017 to December 2018.

RESULTS: Present study showed that majority of the patients were in the summer season, Maximum number of patients was in the age group of 31-40 years in both males and females. males were 16(53.3%) and females were 14(46.7%) with male to female ratio of 1.15:1, majority of the patients had hypokalemic paralysis as their 1st episode, there was no significance of recurrence. only 10 patients (33.33%) had weakness in their upper limbs among them) 9 patients had diminished deep tendon reflexes and only one patient (3.33%) had absent deep tendon reflexes in their upper limbs.

CONCLUSION: This study found that most of the patients had symmetrical limb weakness in the form of paraparesis followed by quadriparesis. This study found that majority of the patients 16(53.3%) had Hypokalemic paralysis due to secondary causes followed by primary Hypokalemic paralysis in 14(46.66%)patients. This study found that only 10% cases of acute Hypokalemic flaccid paralysis with thyroid disorders among them hypothyroidism (6.67%) was common than hyperthyroidism (3.33%).

KEYWORDS : Hypokalemic periodic paralysis, Thyrotoxic periodic paralysis, Hypokalemic flaccid paralysis, Thyroid stimulating hormone, Electrocardiogram.

INTRODUCTION:

Hypokalemic paralysis is a form of metabolic myopathy, which represents a Heterogeneous group of disorder characterized by Hypokalemia, acute flaccid paralysis and fatal episodes of muscle weakness through the involvement of the respiratory muscles, and life threatening cardiac arrhythmias. Hypokalemic periodic paralysis (HKPP), probably the commonest form of periodic paralysis was first reported by Musgrave (1727) having an estimated prevalence of 1 in 1,00,000. Periodic paralysis has a varied distribution in different parts of the world. Thyrotoxicosis is the most common cause of secondary Hypokalemic paralysis. Thyrotoxic Hypokalemic paralysis is common in the Asian population. The first case of THPP was described by Rossenfield in 1902. In India, excepting few no large cases have been reported. Recurrent Hypokalemic paralysis is an extremely unusual presentation of hypothyroidism. Even though it is rare four cases are reported in India till now. Thyroid function test is a simple investigation which could be used to screen the thyroid Function abnormalities in Hypokalemic paralysis patients.

AIMS AND OBJECTIVES:

- To study the thyroid function abnormalities in Hypokalemic paralysis patients
- To screen the patients of Hypokalemic paralysis for thyroid abnormalities whether they are Thyrotoxic and hypothyroid or euthyroid
- To see the association between thyroid function and Hypokalemic paralysis.

MATERIALS AND METHODS:

It is a cross sectional study. Our plan is to see the association of thyroid abnormalities in Hypokalemic paralysis patients. Patients of Hypokalemic paralysis confirmed by clinical history, examination and laboratory investigations were included in the study done at Alluri Sitaramaraju Academy of Medical sciences from June 2017 to December 2018

INCLUSION CRITERIA:

All patients admitted with following features were included in the

study from June 2017 to December 2018....Presented with History of acute onset limb weakness, (bilateral upper and/or lower limb). Demonstration of low serum potassium (serum potassium levels of <3.5meq/l) during the attack of weakness. Reversal of weakness, partial or complete, with administration of potassium

EXCLUSION CRITERIA:

The patients with history of acute flaccid paralysis due to following causes: **Central nervous system pathology:** cerebrovascular disease (ischemic or hemorrhagic), brain abscess, cerebral palsy and multiple sclerosis. **Spinal cord pathology:** cervical spondylosis, degenerative diseases, guillian- barre syndrome, syphilis, syringomyelia, compressive myelopathy (disc prolapse), anterior spinal artery syndrome and spinabifida. **Neuromuscular abnormalities:** poliomyelitis, myasthenia gravis, Lambert Eaton syndrome, peripheral neuropathy. **Local causes:** bursitis, gait abnormalities. **Systemic causes:** anemia (B12 deficiency), porphyrias & malignancy were excluded from the study

METHODOLOGY:

Data was collected from IP patients with signs and symptoms of Hypokalemic paralysis as mentioned above. These patients were clinically examined and they underwent routine investigations like haemogram, serum electrolytes, complete urine examination, urine osmolality and 24 hour urine electrolytes, blood urea, serum creatinine, chest x-ray, random blood sugar, ABG analysis, ECG, liver function tests, CPK, CT brain plain and TSH, FT3, FT4.

- MRC (Medical Research Council) Scale for grading of muscle power
- Grade 0- No power
- Grade 1- flicker of movements
- Grade 2- eliminating gravity
- Grade 3- against gravity
- Grade 4- against resistance
- Grade 5- normal

Patients with power $\geq 4/5$ or more comprised as mild weakness and those with 3/5 or less comprised as severe weakness. After analyzing

all the lab investigations we have divided those 30 patients into two groups:

The first group, patients of Hypokalemic flaccid paralysis with transcellular Potassium shift which included Patients of Hypokalemic flaccid paralysis with normal Acid-base status and a low urinary potassium loss was an important factor to diagnose the patients having transcellular potassium shift. This group includes Idiopathic Hypokalemic paralysis cases were diagnosed if spot urinary potassium excretion is <20mmol/l, in presence of Hypokalemic and 1st attack of flaccid weakness with normal acid base status without any other causes. Hypokalemic periodic paralysis cases were diagnosed if spot urinary potassium excretion is <20mmol/l, in presence of Hypokalemia and flaccid weakness with history of similar episodes in the past with normal acid base status without any other causes. Cases with flaccid weakness and Hypokalemia with spot urine potassium excretion <20mmol/l with increase in FT3 and/or FT4 with decrease in TSH renal having normal acid-base status, were diagnosed as thyrotoxic Hypokalemic periodic paralysis (TPP). Cases with flaccid weakness and Hypokalemia with spot urine potassium excretion <20mmol/l with decrease in FT3 and/or FT4 with increase in TSH renal having normal acid-base status, were diagnosed as hypothyroid hypokalemic periodic paralysis.

The second group of patients with excess renal potassium loss and patients with non-renal potassium loss like diarrhea, excessive Sweating and vomiting. Patients of Hypokalemic flaccid paralysis with a low urinary potassium loss with hypochloremic metabolic alkalosis with vomitings were diagnosed as cases of HKFP due to prior/non renal loss of potassium. Patients of Hypokalemic flaccid paralysis with low renal urinary potassium loss (<20mmol/l) and hyperchloremic metabolic acidosis with diarrhea were regarded as another cause of HKFP due to prior/non renal loss of potassium. Acute flaccid weakness after surgery with Hypokalemia and spot urinary potassium excretion is <20mmol/l, with normal acid base status without any other causes regarded as Hypokalemic paralysis secondary to surgery. Due to certain limitations and lack of genetic analysis we couldn't analyze some of the cases completely.

OBSERVATIONS AND RESULTS:

Thirty cases of Hypokalemic Paralysis patients, admitted in the Department of General Medicine, at Alluri Sitaramaraju Academy of Medical sciences were selected considering the inclusion and exclusion criteria.

Age: Present study showed that minimum age of presentation was 21 years and maximum age of presentation was 75 years. Maximum number of patients was in the age group of 31-40 years (36.69%), followed by 21-30 years (20%).

Gender: Males were 16(53.3%) and females were 14(46%) with male to female ratio of 1.15:1.

Season: Among 30 cases 26 (86.66%) were presented in summer, 2 (6.67%) were presented in rainy season and 2(6.67%) were presented in winter season. Majority of the patients were in the summer season.

Clinical presentation: In this study 20(66.67%) patients were presented with only Para paresis, 9 (29.97%) patients were presented with Quadriparesis and 1(3.33%) patient had Quadriparesis with respiratory arrest.

Recurrence: Present study showed that majority of the patients 20(66.67%) of patients had paraparesis. Among 30 cases 26(86.28%) patients were presented 1st time as hypokalemic paralysis and 4(13.32%) patients had previous history of hypokalemic paralysis episodes. Majority of the patients had hypokalemic paralysis as their 1st episode.

Deep tendon reflexes: Among 30 cases only 10 patients (33.33%) had weakness in their upper limbs, among them 9 patients had diminished deep tendon reflexes and only one patient(3.33%) had absent deep tendon reflexes in their upper limbs. Among 30 cases 28 patients (93.33%) had diminished deep tendon reflexes and only two patients (6.67%) had absent deep tendon reflexes in their lower limbs.

ECG changes: Present study showed that majority of the patients had Hypokalemic changes in their ECG. All patients had broad flat T

waves, ST Depression in their ECG, 12 (40%) patients had QT prolongation, 4(13.2%) patients had decreased voltage and widening of the QRS complex and 2(6.67%) patients had prolonged PR Interval. Majority of the patients had broad flat T wave and ST Depression.

Serum k+ values and severity: This study was showing that among 30 patients, at the time of presentation minimum serum k+ value is 1.0meq/l, maximum serum k+ value is 3.2meq/l, mean serum k+ value is 2.03meq/l and standard deviation is 0.58. Among 30 cases, at the time of presentation 14 (46.66%) patients had critical serum k+ level < 1.5meq/l, 12(40%) patients had severe deficiency with serum k+ value between 2.1-2.5meq/l, 2(6.67%) patients had moderate deficiency with serum k+ value between 2.6-3meq/l and 2 (6.67%) patients had mild deficiency with serum k+ value between 3-3.5meq/l. Majority of the patients 14 (46.66%) had critical K + deficiency with serum k+ level < 2meq/l. Among 30 cases, at the time of presentation there was no correlation between the severity of hypokalemia and severity of weakness.

Etiology: Among 30 patients 14(47%) patients had Primary Hypokalemic paralysis and 16(53%) had secondary Hypokalemic paralysis.

Mechanism of hypokalemia: Among 30 patients 17(57%) patients had Transcellular shift of potassium which includes 10(33%) patients of Idiopathic presentation, 4(13.32%) patients of recurrent attacks(HKPP) and 3(10%) patients had Hypokalemic paralysis with Thyroid abnormalities and 13(43%) patients had non renal K+ loss in which 4(13.32%) patients had vomiting, 8(26.7%) patients had Diarrhea, One patient (3.33%) had post operative Hypokalemic paralysis and No one had renal loss of k+. Majority of the patients had 17(57%) had Transcellular shift of potassium.

Diagnosis: Present study found that out of 30 cases 14(47%) patients had primary Hypokalemic paralysis (which included 4 (13.32%) sporadic Hypokalemic paralysis 10(33.33%) Hypokalemic paralysis due to idiopathic etiology and 16 (53%) patients had secondary Hypokalemic paralysis which included One(3.33) Hypokalemic paralysis with hyperthyroidism, 2(6.67%) Hypokalemic paralysis with hypothyroidism, 8(26.64%) Hypokalemic paralysis due to diarrhea, 4(13.32%) Hypokalemic paralysis due to vomitings and one (3.33%) patient had postoperative Hypokalemic paralysis. Present study found that majority of the patients 10(33.33%) had Hypokalemic paralysis due to idiopathic etiology followed by diarrhea in 8(26.64%).

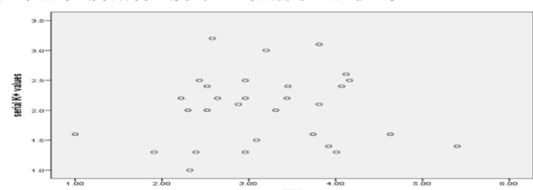
Recovery with treatment: Present study found that out of 30 Hypokalemic paralysis cases 6 patients (20.3%) were recovered in one day, 13 patients (43.3%) were recovered in two days, 9 patients (29.7%) were recovered in three days and 2 patients (6.67%) were recovered in four days. Present study showed that majority of the patients 13(43.3%) had recovery with potassium supplementation in two days.

Thyroid abnormalities in Hypokalemic Paralysis Patients: Among 30 cases, 27 (90%) cases had normal thyroid function, 2(6.67%) cases had hypothyroidism and only one (3.33%) patient had hyperthyroidism. This indicates that majority of the patients 27(90%) had normal thyroid function.

thyroid status	frequency	Percentage
Normal thyroid status	27	90
Hypothyroidism	2	6.67
Hyperthyroidism	1	3.33

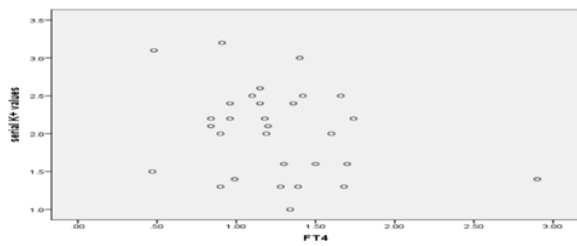
CORRELATIONS

Correlation between Serum Potassium and Ft3



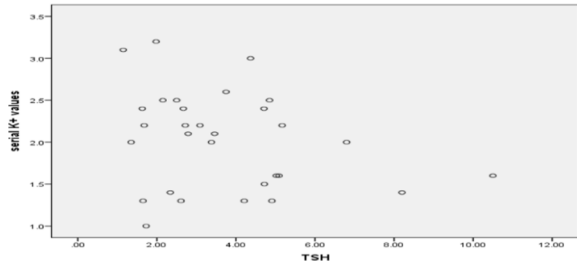
Above graph indicates that there was no correlation between serum potassium and T3 value of Hypokalemic paralysis patients in Present study

Correlation between Serum Potassium and Ft4



Above graph indicates that there was no correlation between serum potassium and T4 values of Hypokalemic paralysis patients in Present study.

Correlation between Serum Potassium and TSH



Above graph indicates that there was no correlation between serum potassium and TSH value of Hypokalemic paralysis patients in Present study. None of the correlation value or P value is significant.

DISCUSSION:

A hospital based cross sectional study was done to know the thyroid function abnormalities in Hypokalemic paralysis patients. The focus of this study is to know the association of thyroid function with Hypokalemia. In the present study, 30 cases of Hypokalemic paralysis (considering the inclusion and exclusion criteria) were detected over a period of 18 months.

Age:

Similar to previous studies present study also showed Maximum number of patients in 3rd decade followed by 2nd decade. The present study showed that minimum age of presentation was 21 years and maximum age of presentation was 75 years, Maximum number of patients was in the age group of 31- 40 years (33.33%), followed by 21-30 years (23.31%). Least number of patients was seen in the age group of 71-80 years (6.66%). Similar to present study Ashok k kayal et al study, Joy deep mukherjee et al study and Biranchi Narayan Mahapatra et al study also had Maximum number of patients in the age group of 31-40 years.

Gender distribution in various studies:

Male preponderance was observed in our study, which has earlier been documented in the Indian literature. In the Present study among 30 cases 16(54%) cases were males and 14(46%) cases were females with male to female ratio of 1.15:1 which indicates slight male predominance as previous studies. The male preponderance was probably due to excessive exposure to heat and exertion following outward activities. Similar to present study Ashok k kayal et al study had male to female ratio of 2.7:1, Ravindra Kumar garg et al study had male to female ratio of 8.6:1, Joy deep mukherjee et al study had male to female ratio of 4.2:1 and Biranchi Narayan Mahapatra et al study had male to female ratio of 7.3:1 which indicates male predominance in all studies.

Seasonal variation:

In the Present study there was a seasonal variation in the incidence of Hypokalemic flaccid paralysis attacks as Biranchi Narayan Mahapatra et al study. Among 30 cases 26(86.66%) were presented in summer, 2(6.67 %) were presented in rainy season and 2(6.67 %) were presented in winter season. This indicates that present study showed that majority of the patients was in the summer season. However, these patients did not have any clinical evidence of dehydration on admission to hospital. These findings in our study are consistent with an earlier Indian study, Biranchi Narayan Mahapatra et al which had also shown high prevalence of cases 29 (58%) out of 50 in the summer season. when the average temperature in this region ranges from 35-

45°C, With an average humidity of about 70% in summer. This can be the one of the factors of high prevalence of cases of Hypokalemic flaccid paralysis in the summer month.

Clinical presentation:

Present study had symmetrical limb weakness in the form of paraparesis or quadriparesis and respiratory paralysis in one patient which was improved with potassium supplementation similar to previous studies. In the present study among 30 cases, 20(6.67%) patients were presented with Paraparesis, 9(29.97%) patients were presented with Quadriparesis. In Ashok k kayal et al study among 56 cases all patients had symmetrical weakness of both upper and lower limbs, in Ravindra Kumar garg et al study among 29 cases all patients had presented with quadriparesis, in Joy deep mukherjee et al study among 32 cases all cases had symmetrical weakness in the form of paraparesis or quadriparesis and In Biranchi Narayan Mahapatra et al study among 50 cases 18 patients had paraparesis, 27 patients had quadriparesis.

Muscle weakness in various studies:

In the present study 4(13.42%) patients had mild weakness (power ≥ 4/5 or more) and 26 (86.58) patients had severe weakness (power 3/5 or less). Only one (3.33%) patient had grade zero power. Whereas, In Biranchi Narayan Mahapatra et al study 4 patients had grade zero power. One patient had involvement of respiratory muscles in which patient required mechanical ventilator support and recovered within 2 days potassium supplementation. Ashok k kayal et al study 2 patients had respiratory paralysis, in Ravindra Kumar garg et al study 2 patients presented with respiratory involvement; none of them required ventilatory support. There was no correlation between the severity of Hypokalemia and severity of weakness

Deep tendon reflexes:

Similar to previous studies present study showed that majority of the Hypokalemic paralysis patients had diminished deep tendon reflexes in their limbs. In this study among 30 cases 28 patients (93.33%) had diminished deep tendon reflexes and only two patients (6.67%) had absent deep tendon reflexes. In this study majority of the patients had diminished DTR'S in their limbs similar to Joy deep mukherjee et al study in which 29 patients had diminished deep tendon reflexes out of 32 patients

ECG Changes:

Unlike previous studies present study showed that all patients had Hypokalemic changes in their ECGs. The present study among 30 cases all patients had Hypokalemic ECG changes and most of them had broad flat T waves along with ST Depression.

Serum potassium levels:

In the present study at the time of presentation minimum serum k+ value was 1.0meq/l and Mean serum k+ value was 2.3meq/l which are very less when compared to other previous studies. Whereas maximum serum k+ value in the present study was 3.2meq/l which is almost similar to previous studies. In this study majority of patients 26(87%) patients had severe deficiency with serum k+ value <2.5meq/l.

Correlation between Serum Potassium and thyroid values

S.NO	Parameter	Pearson correlation value	P value
1	serum K+ & T3	.048	.801
2	serum K+ & T4	-.284	.129
3	serum K+ & TSH	-.269	.150

None of the above value is significant (>0.05).

There was no mortality in this study and all the patients had recovered after initiation of appropriate therapy to the underlying causes in addition to potassium supplementation.

CONCLUSION:

The focus of this study is to see the association of thyroid abnormalities in Hypokalemic paralysis patients. This study found that most of the patients had symmetrical limb weakness in the form of paraparesis followed by quadriparesis. This study found that majority of the patients 16(53.3%) had Hypokalemic paralysis due to secondary causes followed by primary Hypokalemic paralysis in 14(46.66%) patients. This study found that only 10% cases of acute Hypokalemic flaccid paralysis with thyroid disorders among them hypothyroidism (6.67%) was common than hyperthyroidism(3.33%). This study found

that insignificant Pearson correlation value and P value in between serum K⁺ and thyroid function tests (FT3, FT4& TSH).

REFERENCES

1. Sushil K Ahlawat, Anita Sachdev , Hypokalaemic paralysis. Postgraduate Medical Journal 2016; July22.
2. Emre Gezer, Banu Şarer Yurekli, Gokçen Unal Kocabas. Thyrotoxic hypokalemic periodic paralysis in a Turkish patient presenting with a U wave on ECG. Hormones (Athens, Greece)2016; July DOI: 10.14310/horm.2002.1688.
3. Biranchi Narayan Mohapatra, Sujit Kumar Lenka, Manoranjan Acharya, Chakradhar Majhi, Gouri Oram, Khetra Mohan Tudu. Clinical and Etiological Spectrum of Hypokalemic Flaccid Paralysis in Western Odisha. Journal of the association of physicians India 2016; may, vol.64.
4. Joy deep Mukherjee, Durga Prasad Chakraborty, Uma Sinharoy , and Shankar Prasad Saha. Idiopathic hypokalemic periodic paralysis: A series of cases clustered in a part of Eastern India. Asian journal of medical sciences 2015; July.
5. Tsai, Ming-Hsien MD, MPH Lin Shih-Hua MD, Leu Jyh-Gang MD PhD, Fang Yu-Wei MD Medicine. Hypokalemic Paralysis Complicated by Concurrent Hyperthyroidism and Chronic Alcoholism: A Case Report. Research Article: Clinical Case Report 2015; September- Volume 94 - Issue39.
6. Abhishek Vijayakumar, Giridhar Ashwath, and Durganna Thimmappa. Thyrotoxic Periodic Paralysis: Clinical Challenges. Journal of Thyroid Research 2014; Volume (2014); Article ID 649502; 6pages.
7. M Selvaganesh, AMurali, RVMookambika, KJayachandran. Hypokalemic Paralysis and Normocalcaemic Tetany – A Rare Presentation of Sjogren's syndrome. Journal of the association of physicians of India 2013; November • VOL. 61.
8. Ravindra Kumar Garg, Hardeep Sing Malhotra, Rajesh Verma, Pawan Sharma and Maneesh Kumar Singh. Etiological spectrum of hypokalemic paralysis: A retrospective analysis of 29 patients. Indian Academy of Neurology 2013; Jul-Sep, vol.6 (3).
9. Ashok K. Kayal, Munindra Goswami, Marami Das, and Rahul Jain. Clinical and biochemical spectrum of hypokalemic paralysis in North East India. Annuals of Indian Academy of Neurology 2013; Apr-Jun, vol.6 (2).
10. Debmalya Sanyal, Shakya Bhattacharjee. Thyrotoxic hypokalemic periodic paralysis as the presenting symptom of silent thyroiditis. Annuals of Indian Academy of Neurology 2013; Apr-Jun; 16(2):218–220.