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# Hypokalemic paralysis and its correlation on biochemical parameters

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**Abstract**
**Background:** Hypokalemic Paralysis is a relatively common but potentially life threatening syndrome. If recognized and treated appropriately in time, the chances of recovery without any clinical sequelae are high. The syndrome of Hypokalemic Paralysis represents a group of disorders characterized clinically by hypokalemia and acute flaccid weakness. This study was done to analyse the pattern of distribution and comorbidities of Hypokalemic Paralysis.
**Methodology:** This cross sectional study was done among 33 patients who were admitted to our hospital with hypokalemic paralysis. The participants were treated for hypokalemia using the standard protocol. Data was collected regarding the laboratory parameters, electrocardiogram and spot urine sample for potassium excretion.
**Results:** Majority of the participants in our study belonged to 41-50 years of age (36.4%) and were males (91.9%). About 23 participants (69.7%) had quadriparesis and 10 (30.3%) had pain in the limbs. Gastrointestinal symptoms like vomiting was present in 7(21.2%), diarrhoea in 3(9.1%) of the participants. About 21 (63.6%) of the participants had severe hypokalemia.
**Conclusion:** Hypokalemic Paralysis occurs in a much wider range of age group between (21-50 years) with male preponderance. HPP stood as the leading cause among other periodic paralysis. However, a high index of suspicion combined with early diagnosis can ensure high cure rates.

**Keywords:** acute flaccid paralysis, hypokalemia, non hypokalemic periodic paralysis, quadriparesis

## Introduction

Hypokalemic periodic paralysis is a disorder of muscle whereby voltage-gated ion channels (typically calcium or sodium, and less frequently potassium) are mutated, resulting in abnormalities of sarcolemmal excitation. Hypokalemic Paralysis is a relatively common but potentially life threatening syndrome. If recognized and treated appropriately in time, the chances of recovery without any clinical sequelae are high. The syndrome of Hypokalemic Paralysis represents a group of disorders characterized clinically by hypokalemia and acute flaccid weakness.

Hypokalemic Paralysis rarely causes ocular, bulbar or respiratory paralysis. Death may follow in case respiratory paralysis or disturbance in cardiac conduction occurs. The weakness attacks typically occur within the first or second decade of life and after it starts around maturity and reveals itself in the third decade of life. In fourth and fifth decades, the frequency of attacks decrease and even it may stop completely, but the attacks may start as early as four years or as late as 60 years old. The duration of attack may continue from 3 to 4 hours to as long as one or two days. The attack usually occurs following a period of rest and typically they occur in mid night or early morning [1]. This mostly happens in patients with a history of consuming large carbohydrate meal or having strenuous exercise the night before. During an attack the level of serum potassium decrease and it may drop as low as 1.5 mEq/I [2].

The diagnosis of hypokalemic paralysis is often challenging. This acute onset flaccid paralysis usually involves all the four extremities, bur sometimes affects the lower extremities first. It is often misdiagnosed as Gullien-Barrie Syndrome or transverse myelitis and acute spinal cord compression. The differential diagnosis is even more challenging when the patient presents with respiratory paralysis.

## Objective

1. To analyzed the clinical spectrum and complications of hypokalemic paralysis
2. To correlate the hypokalemic paralysis with certain biochemical parameters.

## Methodology

### Study setting

This cross sectional study was carried out in the Department of General Medicine of our medical college hospital in Tamil Nadu between August 2008 and August 2010.

### Study participants

All patients who presented to the Outpatient Department or the Emergency Room with a diagnosis of hypokalemic periodic paralysis were selected for the study. A total of 33 participants were studied during the study period. Participants were selected by purposive sampling.

### Inclusion criteria

1. Age above 12 years
2. Clinical presentation of flaccid paralysis of muscles
3. Biochemical parameters of hypokalemia

### Exclusion criteria

1. Patients below 12 years of age
2. Patients with pre-existing neurological disorders.
3. Patients with chronic systemic illness.

**Ethical approval and informed consent**

Approval from the Institutional Ethics Committee was obtained prior to the commencement of the study. The study was explained in detail to each participant and informed consent was obtained prior to the data collection.

**Data collection**

After recording the background information, initial evaluation with detailed history and physical examination were done. Spot urine sample for potassium excretion were collected before therapy by self voiding or with a Foley's catheter. Arterial blood samples were collected for Arterial Blood Gas (ABG) analysis. Electrocardiogram (ECG) was taken to look for any evidence of hypokalemia. Venous blood samples were collected for biochemistry (serum potassium, chloride, sodium, serum creatinine, blood urea, albumin, total calcium, magnesium, TFT). Complete blood count was also measured. Patients were treated for hypokalemia as per the standard treatment guidelines and were monitored for complications.

**Data analysis**

Data was entered and analyzed using SPSS ver. 16 software. The descriptive statistics were expressed as percentages and test of significance was analyzed using chi square test.

**Results**

This study was done among 33 participants who presented to our hospital with hypokalemic paralysis. Majority of the participants in our study belonged to 41-50 years of age (36.4%) and were males (91.9%). The background characteristics of the study participants are given in table 1.

**Table 1:** Background characteristics of the study participants

| S. No | Characteristics | Frequency N=33 | Percentage (%) |
|---|---|---|---|
| 1 | Age (in years) | | |
| | 21-30 | 9 | 27.3 |
| | 31-40 | 9 | 27.3 |
| | 41-50 | 12 | 36.4 |
| | 51-60 | 1 | 3.03 |
| | 61-70 | 1 | 3.03 |
| | 71-80 | 1 | 3.03 |
| 2 | Sex | | |
| | Male | 30 | 91.9 |
| | Female | 3 | 9.1 |
| 3 | Etiology | | |
| | Hypokalemic Periodic Paralysis | 15 | 45.5 |
| | Acute Gastroenteritis | 4 | 12.1 |
| | Unknown Etiology | 14 | 42.4 |

The clinical features of the study participants are given in table 2. About 23 participants (69.7%) had quadriparesis and 10 (30.3%) had pain in the limbs. Gastrointestinal symptoms like vomiting was present in 7(21.2%), diarrhoea in 3(9.1%) of the participants.

**Table 2**

| S. No | Clinical features | Frequency N=33 | Percentage (%) |
|---|---|---|---|
| 1 | Type of paralysis | | |
| | Quadriparesis | 23 | 69.7 |
| | Para paresis | 10 | 30.3 |
| 2 | Type of Pain | | |
| | Pain in limbs | 10 | 30.3 |
| | Neck pain | 6 | 18.2 |
| | No pain | 17 | 51.5 |
| 3 | Vomiting | | |
| | Present | 7 | 21.2 |
| | Absent | 26 | 78.8 |
| 4 | Diarrhoea | | |
| | Present | 3 | 9.1 |
| | Absent | 30 | 90.9 |
| 5 | Polyuria | | |
| | Present | 5 | 15.2 |
| | Absent | 28 | 84.8 |

The particulars regarding the laboratory parameters are given in table 3. About 21 (63.6%) of the participants had severe hypokalemia. Hyponatremia was found in 23(69.7%) of the participants. Hypocalcemia was found in 20 (60.6%) of the participants. Creatine kinase was increased in 30 (90.9%) of the participants.

**Table 3**

| S. No | Parameter | Frequency N=33 | Percentage (%) |
|---|---|---|---|
| 1 | Serum Potassium (mEq/L) | | |
| | Mild (3-3.5) | 0 | 0 |
| | Moderate (2-3) | 12 | 36.4 |
| | Severe (1-2) | 21 | 63.6 |
| 2 | Serum Sodium (mEq/L) | | |
| | < 135 | 23 | 69.7 |
| | 135-150 | 10 | 30.3 |
| 3 | Serum Chloride (mEq/L) | | |
| | < 95 | 4 | 12.2 |
| | 95-105 | 22 | 66.6 |
| | > 105 mEq/L | 7 | 21.2 |
| 4 | Serum Magnesium | | |
| | Hypomagnesmia | 5 | 15.1 |
| | Normal | 27 | 81.8 |
| | Hypomagnesmia | 1 | 3.1 |
| 5 | Serum Calcium (mEq/L) | | |
| | 8.5-11 | 13 | 39.4 |
| | <8.5 | 20 | 60.6 |
| 6 | Serum Albumin (U/L) | | |
| | 3.5-5 | 11 | 33.3 |
| | <3.5 | 22 | 66.7 |
| 7 | Urine Potassium (mEq/L) | | |
| | <20 mEq/L | 26 | 78.8 |
| | >95 mEq/L | 7 | 21.2 |
| 8 | Thyroid function tests | | |
| | Normal | 30 | 90.9 |
| | Hyperthyrodism | 3 | 9.1 |
| 9 | Metabolic alkalosis | | |
| | Metabolic alkalosis | 3 | 9.1 |
| | Normal | 30 | 90.9 |
| 10 | Creatine Kinase | | |
| | Normal level | 3 | 9.1 |
| | Increased level | 30 | 90.9 |

## Discussion

The syndrome of Hypokalemic Paralysis represents a heterogenous group of disorders characterized clinically by hypokalemia and acute systemic weakness. It is primarily the result of either Hypokalemic periodic Paralysis (HPP) caused by an enhanced shift of potassium into cells or non- HPP resulting from excessive potassium loss.

In our study of the 33 cases, 9 (27.3%) cases were in the age group of 21-30, 9 (27.3%) cases were in the age group of 31-40 and 12 (36.4%) cases were in the age group of 41-50. SA Masoud observed 17 (63%) cases in the age group of 15-34 years [3]. S-H Lin *et al* observed the mean age of presentation was 29±1.1 years, which was lower than our study average.[4,5]

In our study 30 cases (91.9%) were males. A similar observation was found by SA Masoud in which 26 (96.3%) cases were males [3]. S-H Lin *et al* also observed male preponderance. Male: Female ratio= 77:20 in this study [4, 5].

In our study 15 cases (45.45%) were due to HPP and 18 (55.55%) cases were due to non-HPP. In a similar study Shin – Hua lin *et al*, 69.76% were due to HPP and 13 (30.24%) were due to non-HPP stood as the leading cause among Hypokalemic Paralysis [4]. Moreover, in our study it was found that a lower limb was affected in all 33 cases (100%) while upper limb was affected only in 69.7% of the cases indicating that lower limb were more frequently affected than the upper limbs. A similar observation was described by SA Masoud [3].

None of our study participants had familial periodic paralysis. The overwhelming excess of sporadic cases in our study indicates the importance of contributing or precipitating factors like tobacco chewing or alcohol intake which are extremely common in our country.

Among the risk factors of hypokalemia, Licorice a flavouring agent commonly found in alcoholic beverages, snuff, chewing tobacco is associated with a high incident of hypokalemia if ingested in large amount. The clinical manifestations quickly recede upon discontinuation of licorice ingestion [6]. Apart from this, a generalized subsistence on high carbohydrate diet due to poor socioeconomic status of our study participants also is known to aggravate hypokalemia [7, 8].

The other key observation in this study was that the attack was often seen in the nights, similar to other studies [3, 4]. The probable mechanism could be that resting after exercises induces an attack, as our patients are usually manual labourers who were working for many hours till late in the evening and have taken rest in the night after severe exhaustion.

Several studies have indicated the presence of paralytic ileus in association with hypokalemic paralysis, however, it was not observed in any one of our patients [8].

In this study Non specific symptoms like vomiting was observed in 7(21.2%) cases and diarrhoea was present in 3 (9.1%) cases which were relieved promptly when hypokalemia was corrected.

Serum potassium levels were <2 mEq/L (severe) in 21 (63.63%) patients, and between 2-3 mEq/L in 12 (36.36%). Similar findings were observed in a study done by SA Masoud [3].

About 20 (60.60%) cases had hypocalcemia (<8.5 mEq/L) and 5 (15.15%) patients had hypomagnesaemia and 1 (3.03%) had hypomagnesaemia which were corrected. Annie W.C.Kung also observed hypomagnesaemia in two third of her Patients [9] Metabolic alkalosis was seen in 3(9.1%) of the study participants, wherein 78.8% of the participants had urinary excretion of Potassium <20 mEq/L. Creatine kinase was increased in 30(90.9%) participants in our study. Annie W.C.Kung observed that serum Creatine phospokinase of muscle origin is elevated in about two third of the patients, particularly among those whose attacks are precipitated by exercise [9]. The complication of rhabdomyolysis may occur in severe attack. Moreover, ST-T changes were seen in 13(39.39%) cases, U waves were detectable in 20 (60.61%) cases on ECG, and similar picture was also observed by SA Masoud [3]. However, none of them developed any serious complications.

**Conclusion**

Hypokalemic paralysis is a very common disease among the poor patients. However, a high index of suspicion combined with early diagnosis can ensure high cure rates. Hypokalemic Paralysis occurs in a much wider range of age group between (21-50 years) with male preponderance. HPP stood as the leading cause among other periodic paralysis and none of the patients developed any serious complications including death in our study. However, a large study involving different regional and ethnic groups may bring out the actual cause. The study would have gained strength with an increased sample size been and Trans-tubular potassium gradient and muscle biopsy to support the evidence.

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