RHABDOMYOLYSIS ASSOCIATED WITH HYPOKALAEMIC PERIODIC PARALYSIS OF RENAL TUBULAR ACIDOSIS

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ABSTRACT

Two cases of hypokalaemia with serum potassium levels of 1.4 mmol/L and 1.9 mmol/L causing severe periodic paralysis since childhood are presented. There were associated with muscular aches and markedly raised muscle enzymes suggesting massive rhabdomyolysis. These abnormalities were due to renal tubular acidosis with markedly acidic arterial pH. The hypokalaemia and rhabdomyolysis responded to potassium and bicarbonate replacement. We postulate these patients had sporadic distal type of renal tubular acidosis and that the hypokalaemia and acidosis had caused the rhabdomyolysis.

Keywords: Rhabdomyolysis, hypokalaemia, paralysis, renal tubular acidosis.

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INTRODUCTION

Rhabdomyolysis is a clinical and laboratory syndrome resulting from skeletal muscle injury releasing muscle cell contents into the plasma resulting in increased plasma concentrations of various substances such as myoglobin (Mb), creatine kinase (Ck) and lactate dehydrogenase (LDH). The presence or absence of myoglobinuria depends on the amount of myoglobin released into plasma, the glomerular filtration rate and the urine concentration.

Hypokalaemic periodic paralysis is characterized by episodic attacks of muscle weakness. The attacks are associated with a shift of potassium, water and sodium from plasma into muscle cells. The attacks are precipitated by exercise, ingestion of sodium chloride, or a large high carbohydrate meal. Insulin may play an important role and it it has been postulated that the basic abnormality of the disorder consists of an amplification of the normal response of muscle fibres to insulin (1).

Hypokalaemic periodic paralysis complicating Renal Tubular Acidosis (RTA) is not uncommon. However, the association of hypokalaemic rhabdomyolysis due to RTA is rare and the first case was reported in 1972 (2). We report here two such patients.

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CASE 1

A 34 year old male prisoner was admitted with recurrent attacks of periodic paralysis of the limbs. The first attack occurred at the age of 10 years. He fully recovered after a month's hospitalisation. He remained symptomatic for the next 22 years until he was readmitted with similar illness in October 1985, January/February/April 1986, November 1987 and January 1988. Weakness always started in the lower limbs which then progressively worsened to involve his arms, trunk and neck until he was unable to walk, sit up to take care of himself. There was no history of dysphagia, dyspnea, polyuria or polydipsia. Each attack lasted for about 1 to 2 weeks. He recovered with potassium supplement. There was no known provoking factor prior to each attack. There was no history of thyroid disease, changes in bowel habits, renal stone, hypertension or diabetes. During the last 2 admissions, he had had generalised myalgia and polyarthralgia. However, he had not noticed any change in his urine colour. Family history was non-contributory. He had been a drug addict since 1979 and was on intravenous heroin injections since 1983 until he was detained by the police in August 1987.

Physical examination revealed a well-built muscular man. He was almost totally quadriplegic. Blood pressure was 110/80 mmHg; pulse rate 84/min and respiratory rate 18/min. There were no ptosis or ophthalmoplegia. Fundi were normal. All cranial nerves were intact. Muscle power was grade 2/5 in all 4 limbs. The lower limbs were areflexic. There was no sensory deficit. There was generalised tenderness of muscles over the limbs on palpation. Other systems were normal.

Initial investigations showed severe hypokalaemia of 1.4 mmol/L. Arterial blood gases showed severe metabolic acidosis of pH 7.06 and bicarbonate level of 10 mmol/L. Serum chloride was 118 mmol/L (Normal

range = 96-108 mmol/L. The urine pH was 6.15 and 24 hours urinary calcium was 5.7 mmol/24 hours (Normal up to 5.0 mmol/24 hours) and potassium was 69.7 mmol/24 hours (Normal = 26 – 123 mmol/24 hours). Thyroid function tests were normal. ECG showed prominent 'u' waves in all leads. Abdominal Xray was normal.

Both creatine phosphokinase (CPK) and lactate dehydrogenase (LDH) were markedly raised at 4695 U/L (Normal = 24–195 U/L in male) and 708 U/L (Normal = 230 – 460 U/L) respectively indicating severe skeletal muscle damage. Unfortunately our laboratory could not measure myoglobin in the urine.

He was given intravenous and oral potassium. His acidosis was treated with Shohl's solution. His serum potassium returned to 3.4 mmol/L on day 7 with almost full recovery of his muscle power.

CASE 2

A 16 year old school girl was admitted with recurrent paralysis of the limbs since 1986. The first attack occurred after she returned from school and she was warded for 10 days. She defaulted follow-up. The present attack was precipitated by a febrile illness. She also complained of generalised myalgia and polyarthralgia. There was no history of prolonged drug ingestion or thyroid disease. There was no family history of similar illness.

On examination she was conscious and able to speak easily. There was no ophthalmoplegia. Her thyroid was not enlarged. Blood pressure was 120/80 mmHg and pulse rate 80/min. Respiratory rate was 16/min. All cranial nerves were grossly intact. The muscle power was grade 3/5 in all limbs. Muscle tone was flaccid. She was hyporeflexic in all 4 limbs. There was no sensory deficit. Other systems were essentially normal.

Her serum potassium on admission was 1.9 mmol/L. Arterial blood gases showed severe metabolic acidosis with pH 7.10 and serum bicarbonate 12 mmol/L. Her serum chloride was 110 mmol/L. Electrocardiogram showed prominent 'u' waves in all leads with runs of ventricular premature beats. Urine pH on admission was 6.2. and urinary potassium 73 mmol/24 hour. Her muscle enzymes on admission were raised (CPK = 4036 U/L, LDH = 1155 U/L). Her renal function was normal. Abdominal Xray was normal.

DISCUSSION

Hypokalaemia and muscle paralysis associated with myoglobinuria was first reported by Heitzman et al in 1962 in a patient with regional enteritis (3). Since then, this form of "hypokalaemia myopathy" has been reported in laxative abuses, villous adenoma of rectum/colon, amphothericin B therapy, pseudohyperaldosteronism state, parenteral hyperalimentation, carbenoxolon therapy and renal tubular acidosis. Both our patients had renal tubular acidosis (RTA) because there was systemic acidosis with inappropriately alkaline urine pH, hyperchloraemia with low serum bicarbonate and hypercalciuria. The urinary potassium excretion was inappropriately high for the very low serum potassium. This RTA is consistent with the distal type of tubular acidosis. There were no clinical features to suggest thyrotoxic hypokalaemic periodic paralysis, and in such conditions, there is no associated acidosis. There were no clinical features to suggest other possible causes of proximal type of tubular acidosis such as Wilson's disease or galactosaemia. These patients did not require excessive amounts of bicarbonate solution to correct their acidosis, as would occur in proximal tubular acidosis. There were no proteinuria nor amino aciduria. Thus these two patients had the sporadic distal type of renal tubular acidosis.

The question could be raised as to which came first, the rhabdomyolysis or the RTA. There is no simple answer to this, but in both cases there were no known cause for rhabdomyolysis to occur or to recur, such as viral myositis, toxins, or trauma. Furthermore, in rhabdomyolysis, there would be hyperkalaemia rather than hypokalaemia, and rhabdomyolysis would cause acute tubular necrosis and renal failure rather than renal tubular acidosis.

The mechanism by which hypokalaemia causes rhabdomyolysis is not clear. It has been shown that potassium has vasodilatory effect on peripheral blood vessels. This was supported by a study whereby an intra-arterial infusion of potassium chloride causes an increase in muscle blood flow (4). Conversely, in prolonged hypokalaemia, the blood supply to the muscle may become impaired resulting in muscle ischaemia, decrease in glycolysis and activation of lipolysis activity. The net result is accumulation of free fatty acids (FFA) on the cell membrane causing changes in integrity and permeability of the sarcolemma with consequent leakage of muscle enzyme and release of potassium into plasma. This mechanism may explain why some patients with hypokalaemic periodic paralysis recover spontaneously, but in both our patients, they only recovered with potassium supplements.

Acidosis per se has not been well documented to cause rhabdomyolysis. However ethanol poisoning, diabetic ketoacidosis (5) and lactic acidosis have been associated with attacks of rhabdomyolysis. The mechanism is unknown but it has been postulated to be due to a direct toxic effect of acidosis on skeletal muscles.

Heroin intoxication can cause rhabdomyolysis. Our first patient was a drug addict until August 1987. However he had stopped the habit when he was detained in August 1987. It is thus unlikely that his rhabdomyolysis was due to heroin addiction.

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