CASE REPORT

Hyponatraemia induced hyperCKaemia

Ketki Khandhadiya,¹ Krishnananda Prabhu,¹ K N Shivashankara,² Pragna Rao¹

¹Department of Biochemistry, Kasturba Medical College, Manipal University, Manipal, Karnataka, India
²Department of Medicine, Kasturba Medical College, Manipal University, Manipal, Karnataka, India

Correspondence to

Dr Krishnananda Prabhu,
 krishnakunj2000@yahoo.com

SUMMARY

A 32-year-old woman presented to Kasturba Hospital, Manipal with the features of gastroenteritis and one episode of generalised tonic clonic seizure with loss of consciousness for 5 min. No abnormalities were found during neurological examination. Her baseline investigations showed low sodium, low serum osmolality, normal renal and liver function tests, urine myoglobin and antinuclear antibodies profile were negative. Incidentally her creatine kinase (CK) levels were found to be very high. She was treated with intravenous fluids and high salt diet for hyponatraemia. With correction of hyponatraemia, CK levels also improved, suggesting the probable diagnosis of hyponatraemia induced myopathy leading to hyperCKaemia. The importance of early recognition of this potentially-dangerous and rare condition is emphasised.

BACKGROUND

Hyponatraemia-induced myopathy leading to elevated creatine kinase (CK) levels (hyperCKaemia) is a rare condition, which might go unnoticed, as hyponatraemia is not known to cause hyperCKaemia. This condition might lead to myopathy-induced renal damage, hence treating hyponatraemia within appropriate time, is very necessary.

CASE PRESENTATION

A 32-year-old woman was admitted to a tertiary care hospital with the symptoms of nausea, easy fatigability, loose stools for 10 days and one episode of seizure 5 days ago. The patient was apparently normal 10 days ago. She developed three episodes of watery, not blood-stained, mucoid diarrhoea, which was associated with epigastric pain, not radiating to the back. Previous to 5 days, she developed one episode of generalised tonic-clonic seizure, associated with tongue biting and loss of consciousness lasting for 5 min. On physical examination, she was

moderately built and nourished, well oriented, conscious and cooperative, she did not have any signs of dehydration or orthostatic hypotension. On admission, her blood pressure was 120/80 mm Hg and pulse rate was 98/min. No abnormalities were found during the neurological examination.

Presenting symptoms and a history of present illness points towards possibility of gastroenteritis leading to salt and water loss. There was no history of chest pain, breathlessness, cough or palpitations, which rules out the possibility of myocardial infarction.

INVESTIGATIONS

Baseline blood tests such as haemoglobin 10.7 g/dL, platelet count $152 \times 10^3/\mu\text{L}$, serum creatine 0.5 mg/dL, blood urea 8 mg/dL, total bilirubin 0.8 mg/dL, direct bilirubin 0.3 mg/dL, aspartate aminotransferase 45 IU/L, alanine transaminase 31 IU/L, alkaline phosphatase 58 IU/L, thyroid-stimulating hormone (TSH) 1.320 $\mu\text{IU/L}$, basophil 0.3%, eosinophil 0.5%, monocyte 11%, lymphocyte 12.3%, neutrophil 75.9%, total white cell count $6.7 \times 10^3/\mu\text{L}$, erythrocyte sedimentation rate 9 mm/h and coagulation profile were within normal limits; random urine sodium was 165 mmol/L. Serum sodium 111 mmol/L, serum potassium 4.1 mmol/L, serum osmolality 249 mOsmol/kg of water, serum CK 14 143 U/L on day 1 and showed gradual improvement with normalisation of sodium level by 13th day (figures 1 and 2). Urine myoglobin and antinuclear antibodies profile were negative.

DIFFERENTIAL DIAGNOSIS

A 32-year-old woman presented with features of gastroenteritis; investigation showed hyponatraemia with incidental finding of hyperCKaemia. HyperCKaemia due to myocardial infarction was ruled out with a negative history of chest pain and

Figure 1 Serial estimation of CK levels.

To cite: Khandhadiya K, Prabhu K, Shivashankara KN, et al. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2013-200398

Figure 2 Serial estimation of sodium levels.

palpitations, thyroid disease was ruled out by normal TSH levels, inflammatory myopathy was ruled out by normal inflammatory profile, haematopathy was ruled out by normal coagulation profile and neuromuscular diseases was ruled out from age group and history. As days progressed, from the investigations, it was noticed that as sodium levels improved, CK levels also reduced (figures 1–3). Her random urine sodium showed normal value in spite of hyponatraemia and she was suspected to have syndrome of inappropriate anti-diuretic hormone (ADH) secretion (SIADH) and was advised fluid restriction.

TREATMENT

The patient was treated with double-strength saline, fluid restriction and high-salt diet.

OUTCOME AND FOLLOW-UP

As the patient symptomatically and clinically improved, she was discharged from the hospital with advice to review after 2 weeks with sodium, potassium and CK levels report. The patient did not turn-up in out patient department.

Figure 3 Correlation of sodium and creatine kinase levels.

DISCUSSION

HyperCKaemia is primarily a marker of myocardial infarction,¹ Duchenne muscle dystrophy, rhabdomyolysis. Other conditions where hyper CK have been reported include severe exercise, muscle injury, pregnancy, drugs (eg, cholesterol-lowering agents), malignancies, alcohol, toxins, infections, hyperthermia, thyroid and parathyroid diseases, haematopathies, inflammatory myopathy, hereditary metabolic myopathies and caveolinopathies.² Chronic persistent hyperCKaemia is occasionally encountered in apparently healthy individuals, in 'idiopathic hyperCKaemia' where no clinical and histopathological evidence of neuromuscular disease has been observed.³ HyperCKaemia occurring due to hyponatraemia is never a possibility.

Clinical judgement of hyponatraemia is often difficult because of its non-specific symptoms. In acute onset hyponatraemia (<120 mmol/L), though treating the primary underlying disease is important, immediate correction of sodium becomes mandatory to avoid hyponatraemia-related morbidity and mortality.⁴

In this case, the patient presented with gastroenteritis with vomiting resulting in hyponatraemia. As her random urine sodium was within normal limits in spite of hyponatraemia, a possibility of SIADH was considered and was treated with fluid restriction, high-salt diet and double-strength saline. As the days of hospitalisation progressed she improved symptomatically along with the normalisation of serum sodium and CK levels. Normal renal function tests and urine for myoglobin being negative on day 5, ruled out the possibility of myopathy-induced renal damage. Also, an improvement in serum sodium levels resulted in gradual reduction and normalisation of CK levels indicating a possibility of hyponatraemia-induced myopathy. The underlying pathophysiology for hyponatraemia induced myopathy is still not clear. The proposed mechanism is the malfunction of muscle cell membrane Na^+ Ca^{2+} pump that can lead to rise in intracellular Ca^{2+} and activation of neural protease and lipase, which could trigger myopathy leading to hyperCKaemia.^{4 5}

However, hyponatraemia-induced hyperCKaemia, in this case, can only be a provisional diagnosis as no definitive test to prove this pathology is available. In this case report, we want to alert the medical community about this rare complication of hyponatraemia.

Learning points

- ▶ Family doctors occasionally find elevated creatinine kinase (CK) levels (hyperCKaemia). Common causes include myocardial damage, other muscle injury or heavy exercise; neuromuscular disorders like Duchenne dystrophy or use of cholesterol-lowering medication. Other less common causes include pregnancy, hyperthermia and thyroid and parathyroid abnormalities.
- ▶ Workup of hyperCKaemia should include a careful history, neuromuscular examination, blood work and consideration of muscle biopsy, if necessary. If all results are negative, a diagnosis of idiopathic hyperCKaemia can be made by exclusion.
- ▶ Hyponatraemia-induced myopathy leading to hyperCKaemia is a rare condition, which might go unnoticed, as hyponatraemia is never a known cause of hyperCKaemia.

Acknowledgements The authors would like to acknowledge the Dean of Kasturba medical college, Manipal.

Contributors KK was involved in the conception and design, acquisition of data or analysis, interpretation of data, and also in drafting of the article. KP was involved in the revision of the article for important intellectual content. KNS and PR were involved in the final approval of the version published.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Wallimann T, Dolder M, Schlattner U, *et al*. Some new aspects of creatine kinase (CK): compartmentation, structure, function and regulation for cellular and mitochondrial bioenergetics and physiology. *Biofactors* 1998;8:229–34.
- 2 Prella A, Tancredi L, Sciacco M, *et al*. Retrospective study of a large population of patients with asymptomatic or minimally symptomatic raised serum creatine kinase levels. *J Neurol* 2002;249:305–11.
- 3 Fernandez C, De Paula AM, Figarella-Branger D, *et al*. Diagnostic evaluation of clinically normal subjects with chronic hyperCKemia. *Neurology* 2006;66:1585–7.
- 4 Trimarchi H, Gonzalez J, Olivero J. Hyponatremia associated rhabdomyolysis. *Nephron* 1999;82:274–7.
- 5 Slater MS, Mullins RJ. Rhabdomyolysis and myoglobinuric renal failure in trauma and surgical patients, a review. *J Am Coll Surg* 1998;186:693–716.

Copyright 2013 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow