Association of hyponatremia and osteoporosis by analyzing serum sodium levels in elderly intertrochanteric fracture patients by Beckman coulter machine

Saksham Sharma¹, Rohit Pahadiya²*, S.C. Vijayvergia³, Shiv Bhagwan Sharma⁴

¹²³PG Resident, ³Professor, ⁴Senior Professor and Unit Head, Dept. of Orthopaedics, S.R.G. Hospital and Jhalawar Medical College, Jhalawar, Rajasthan, India

*Corresponding Author: Rohit Pahadiya
Email: drsakshamthesage@gmail.com

Abstract

Introduction: Hyponatremia is the most common electrolyte disorder seen in clinical practice, it is defined as a serum sodium concentration of less than 135 mmol/L, and there is accumulating evidence that even mild hyponatremia is associated with increased morbidity and mortality, furthermore it can be a novel marker for fracture risk.

Materials and Methods: The study was conducted in department of orthopaedics, S.R.G. Hospital and Medical College, Jhalawar (Rajasthan). The study comprised of 78 patients (48 males and 30 females) with intertrochanteric fractures.

Observations and Results: Out of total 78 patients taken in study 61 were found to be hyponatremic. Out of 48 males in study 39 were hyponatremic, and out of 30 females 22 were hyponatremic.

Keywords: Hyponatremia, Osteoporosis.

Introduction

Hyponatremia is most common electrolyte disorder seen in clinical practices,¹ it is defined as a serum sodium concentration of <135 mmol/L, and there is evidence that mild hyponatremia are associated with increased morbidity and mortality,²–⁵ furthermore it can be a novel marker for fracture risk.

Studies demonstrate that a large amount of body sodium is stored in bone matrix⁶ suggesting that bone may serve as a mobilize of sodium reservoir during periods of homeostatic stress.

My Study indicate that acute hyponatremia can induce a wide spectrum of neurological deficits, ranging from mild symptoms to more significant disorders. The neurological dysfunctions associated with hyponatremia have been shown to include gait instability⁷ and fall on ground,⁸,⁹,¹¹ both of which could compound patient fracture risk.

My study aims to contribute to data concerning hyponatremia and fractures by determining the relationships between hyponatremia and fractures among a cohort of elderly patients presenting to S.R.G. Hospital, Jhalawar, Rajasthan, India with intertrochanteric fractures considering these fractures to be direct result of decreased bone mineral density.

Materials and Methods

Subjects

Table 1

| S. No. | Age (in years) | Sex | Serum Na⁺ level (in mmol/L) |
|--------|----------------|-----|---------------------------|
| 1      | 77             | F   | 127                       |
| 2      | 85             | M   | 132                       |
| 3      | 75             | M   | 130                       |
| 4      | 80             | M   | 131                       |
| 5      | 65             | F   | 134                       |
| 6      | 80             | F   | 134                       |
| 7      | 66             | F   | 132                       |
| No. | Age | Sex | ID  |
|-----|-----|-----|-----|
| 8   | 68  | F   | 135 |
| 9   | 70  | M   | 128 |
| 10  | 65  | F   | 132 |
| 11  | 82  | F   | 141 |
| 12  | 70  | M   | 120 |
| 13  | 70  | F   | 131 |
| 14  | 61  | F   | 133 |
| 15  | 70  | M   | 134 |
| 16  | 80  | F   | 139 |
| 17  | 62  | M   | 137 |
| 18  | 77  | M   | 134 |
| 19  | 62  | M   | 136 |
| 20  | 82  | F   | 141 |
| 21  | 78  | F   | 127 |
| 22  | 80  | F   | 128 |
| 23  | 64  | M   | 124 |
| 24  | 70  | M   | 128 |
| 25  | 65  | F   | 131 |
| 26  | 68  | M   | 131 |
| 27  | 78  | M   | 129 |
| 28  | 75  | M   | 141 |
| 29  | 65  | F   | 141 |
| 30  | 65  | F   | 138 |
| 31  | 65  | F   | 137 |
| 32  | 69  | F   | 137 |
| 33  | 85  | F   | 129 |
| 34  | 74  | F   | 133 |
| 35  | 62  | M   | 136 |
| 36  | 70  | M   | 141 |
| 37  | 65  | M   | 135 |
| 38  | 65  | M   | 148 |
| 39  | 70  | F   | 126 |
| 40  | 70  | F   | 133 |
| 41  | 80  | M   | 135 |
| 42  | 70  | F   | 131 |
| 43  | 85  | F   | 133 |
| 44  | 65  | F   | 122 |
| 45  | 70  | M   | 135 |
| 46  | 80  | M   | 142 |
| 47  | 70  | F   | 138 |
| 48  | 70  | F   | 131 |
| 49  | 70  | M   | 141 |
| 50  | 65  | M   | 138 |
| 51  | 62  | F   | 131 |
| 52  | 75  | M   | 132 |
| 53  | 80  | M   | 124 |
| 54  | 67  | M   | 128 |
| 55  | 61  | M   | 127 |
| 56  | 84  | M   | 133 |
| 57  | 75  | M   | 135 |
| 58  | 68  | F   | 128 |
| 59  | 69  | M   | 124 |
| 60  | 78  | M   | 129 |
| 61  | 75  | M   | 123 |
| 62  | 74  | M   | 134 |
| 63  | 85  | M   | 128 |
| 64  | 74  | M   | 134 |
| 65  | 76  | F   | 133 |
| 66  | 71  | M   | 128 |
| 67  | 61  | M   | 134 |
| 68  | 77  | M   | 130 |
Discussion
We found that in our study 61 patients out of 78 i.e. around 78% had serum sodium levels < 135 mmol/L. Our results are consistent with previous studies that have reported on associations between hyponatremia and fractures. A case control study identified 513 cases of hip region fractures after a fall and fracture, by about 3 fold in men and women with hyponatremia (<135mmol/L), even after giving medications and medical conditions known to confound that association between fracture and serum sodium. Another second case control study reported on the prevalence of hyponatremia (<135mmol/L) among 364 subjects presenting to the hospital with fractures of the hip/pelvis and femur compared with the incidence of hyponatremia in 364 controls.

Hyponatremia appears to contribute to falls and fractures by two mechanisms:
1. It produces mild cognition impairment resulting in disturbing gait and falls.
2. It directly contributes to bone demineralization and increased bone fragility by inducing increased bone resorption to mobilize sodium.

Chart 1

There is growing evidence that complications of hyponatremia include bone loss and osteoporosis, though unknown mechanism Hyponatremia can directly stimulate osteoclast genesis and osteoclastic resorption without activating of signals through osteoblasts. My study had some limitations. Most importantly, it is not possible to conclude that hyponatremia causes fractures and that correcting serum sodium will reduce the risk of fractures.

Conclusion
Hip fractures in person more that >60 years are frequently caused by a sudden fall on the ground, often produced by gait disturbances due to glutamate, which are also known to be associated with sodium disturbances.

Conflict of Interest: None.

Source of Funding: Nil.

References
1. Upadhyay A, Jaber BL, Madias NE. Incidence and prevalence of hyponatremia. *Am J Med* 2006;119(7 suppl 1):S30–S5.
2. Wald R, Jaber BL, Price LL, Upadhyay A, Madias NE. Impact of hospital-associated hyponatremia on selected outcomes. *Arch Intern Med* 2010;170(3):294–302.
3. Corona G, Giuliani C, Parenti G. Moderate hyponatremia is associated with increased risk of mortality: evidence from a meta-analysis. *PLoS One* 2013;8(12):e80451.
4. Kim WR, Biggins SW, Kremers WK. Hyponatremia and mortality among patients on the liver-transplant waiting list. *N Engl J Med* 2008;359(10):1018–26.
5. Klein L, O’Connor CM, Leimberger JD. Lower serum sodium is associated with increased short-term mortality in hospitalized patients with worsening heart failure: results from the Outcomes of a Prospective Trial of Intravenous Milrinone for Exacerbations of Chronic Heart Failure (OPTIME-CHF) study. *Circ* 2005;111(19):2454–60.
6. Harrison HE. The sodium content of bone and other calcified material. *J Biol Chem* 1937;120:457–62.
7. Verbalis JG, Barsony J, Sugimura Y. Hyponatremia-induced osteoporosis. *J Bone Miner Res* 2010;25(3):554–63.
8. Barsony J, Manigrasso MB, Xu Q, Tam H, Verbalis JG. Chronic hyponatremia exacerbates multiple manifestations of senescence in male rats. *Age (Dordr)* 2013;35(2):271–88.
9. Renneboog B, Musch W, Vandemergel X, Manto MU, Decaux G. Mild chronic hyponatremia is associated with falls, unsteadiness, and attention deficits. *Am J Med* 2006;119(1):71–8.
10. Rittenhouse KJ, To T, Rogers A. Hyponatremia as a fall predictor in a geriatric trauma population. *Inj* 2015;46(1):119–23.
11. Tachi T, Yokoi T, Goto C. Hyponatremia and hypokalemia as risk factors for falls. *Eur J Clin Nutr* 2015;69(2):205–10.
12. Gankam Kengne F, Andres C, Sattar L, Melot C, Decaux G. Mild hyponatremia and risk of fracture in the ambulatory elderly. *QJM* 2008;101(5):583–8.
13. Sandhu HS, Gilles E, DeVita MV, Panagopoulos G, Michelis MF. Hyponatremia associated with large-bone fracture in elderly patients. *Int Urol Nephrol* 2009;41:733–7.
14. Barsony J, Sugimura Y, Verbalis JG. Osteoclast response to low extracellular sodium and the mechanism of hyponatremia-induced bone loss. *J Biol Chem* 2011;286:10864–75.

How to cite this article: Sharma S, Pahadiya R, Vijayvergia SC, Sharma SB. Association of hyponatremia and osteoporosis by analyzing serum sodium levels in elderly intertrochanteric fracture patients by Beckman coulter machine. *Indian J Orthop Rheumatol* 2019;5(1):11-3.