ORIGINAL ARTICLE

Efficient Effect of Chronic Methylcobalamin Administration on Cerebellar Purkinje Cell Diameter (A Study in Albino Rats)

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ABSTRACT

Background: Cerebellar cortex contains five varieties of neurons granule cells, basket, Purkinje, granule, Golgi and three layers molecular, Purkinje, granule cell layer. Purkinje cells are the only sole output of cerebellar cortex. Neurons were distorted by the use of Lithium Carbonate which is popularly used in psychiatric disorder.
Aim: To provide a morphometric data of restoration of Purkinje cell diameter after 6 weeks use of injectable methylcobalamin.
Method: Fifteen animals were given Lithium Carbonate and methylcobalamin for a period of 6 weeks.
Results: Results obtained of the restored Purkinje cell diameter supported the need of educating the consultants in prescribing methylcobalamin in psychiatric disorders.
Conclusion: The strength of this study is a documented proof of the restoration of Purkinje cell diameter after methylcobalamin administration which will help in prescribing methylcobalamin as the neuroprotector in future.
Keywords: Purkinje Cells, Restoration, neuroprotector.

INTRODUCTION

Lithium has been first time drug for the bipolar disorder[1], but it is well known for neurological and behavior effects in humans[2]. It was reported by Tataghat et al[3] that Lithium Carbonate was the cause of cerebellar degeneration due to Purkinje cell loss.

Cerebellum is an important component of brain motor system. The cerebellar cortex consists of five types of neurons; Purkinje, granule, stellate, basket and granule cells, the Purkinje plays a pivotal role in the electrical output[4]. The damaged cerebellar Purkinje neuron cells were restored by the use of methyl cobalamin[5].

Methylcobalamin preparation of Mecobalamin coenzyme type vitamin B12[6] and consists of corrins ring[7], 4 pyrrole rings (tetrapyrole), central cobalt (co) atom, bonded with4 equatorial nitrogen ligands[8].

Vitamin B12 is essential for the synthesis of Thymidylate which is characteristic base of DNA[9] and is necessary for the maintenance of nervous system[10]. Methyl is strongly reported to protect neuron against soft metal toxicity[11].

METHODS

This study was conducted in the Anatomy Department of BMSI, JPMC. A total of 15 animals weighing 200 to 250 grams were taken for this study and they were given lithium carbonate 20 mcg in powder form orally[12] and methylcobalamin at a dose of 200mcg/kg intraperitoneally/OD[13].

Results of group C at a period of 6 weeks were documented. The animals were sacrificed at the end of 6 weeks, and the cerebellum was separated from the rest of the brain. Right portion of cerebellar tissue was treated by alcohol cleared by xylene and infiltrated by paraffin. Paraffin blocks were prepared with the tissue. Four micron thick transverse sections of the cerebellar tissues were taken and stained with formal thionin.

Micrometry was done for Purkinje cell diameter in horizontal axis under magnification of 40 x. Right portion of cerebellum was removed and after tissue treatment paraffin blocks were sectioned, floating sections on slides fixed and stained withHaematoxylin and Eosin. Purkinje cell diameter was taken in horizontal axis with ocular micrometer.

Statistical analysis: Statistical analysis was conducted by using SPSS version-16. Statistical differences between means and experimental data were carried out by student 't' test. The difference was regarded highly significant if the p-value was equal or less than 0.001, significant, when p-value is 0.005 to 0.049, significant when p-value is 005 for this study.

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RESULTS

Mean values of diameter of cerebellar purkinje cells (um) in lithium carbonate and methylcobalamin treated Group-C of albino rats

Group	6th Week		P value
	Mean	SEM	
C (Normal Diet + Lithium + Inj. Methylcobalamin)	9.4	0.24	P<0.001****

**** Highly Significant

DISCUSSION

Kaidanovich-Beilin and Woodgett[13] in their study had reported a significant decrease in Purkinje cell diameter due to inhibition of GSK-3αin rat cerebellum. The same is

reported in our study by the use of Lithium Carbonate but an increase in Purkinje cell diameter in methylcobalamin treated group.

The distorted Purkinje cell diameter by the administration of Lithium was also seen by Kaidanovichand reversed by the Methylcobalamin. The same observations are in agreement with Gauren et al[15] they in their study observed that vitamin B12 blocks oxidative damage and dysfunction of cellular proteins leading to survival of functionally active cells.

Our observations of group C are in complete agreement with the study of Kaidanovich-Beilin and Woodgett[13].

In the light of above consideration our research has proved that vitamin B12 methylcobalamin restores Purkinje cell neuronal diameter.

CONCLUSION

The present study suggested that Lithium disrupted the purkinje cell diameter and methylcobalamin ameliorated the toxic effects.

REFERENCES

1. de Cerqueira ACR, dos Rela MC, Novle FD, Bozorra JMF, do Magalhaos GC,Rozenthal M, Nardl AE. Gerebellar degoneratlon vocondary to acutoLitium carbonate intoxication. Arq Neuropslqulatr 2008; 00(3-A):578-80
2. Clarkson TW. Metal toxicity in the central nervous system. Environ health. Perspect 1987; 75:59-64.
3. Tathagat M, Nadeem A, Mishra S, Chaudhary M, Joshi DK, Advani U, TripathiS. Antioxidant status in Lithium induced cerebellar toxicity in rat CNS,Dissertation. NIM University Shobha Nagar India; 2012; p1-15.
4. Kaidanovich-Beilin O, Lipina TV, Takao K, van Eede M, Hattori S, Laliberte C, Khan M, Okamoto K, Chambers JW, Fletcher PJ, MacAulay K, DobleBW, Henkelman M, Miyakawa T, Roder J, Woodgett JR. Abnormalitiesin brain structure and behavior in GSK-3alpha mutant mice. MolecularBrain 2009; 2:35.
5. Shaikh BA. The radioprotective role of methycobal on cerebellar cortex ofvoung albino rats: A histological study. M.Phil Thesis, Department ofAnatomy, BMSI, JPMC, Karachi, 2010; 39.
6. Boullata JIL Nutrients and Associated Substances, In: Hendrickson R. EditorRemington, The Science and Practice of Pharmacy. 21 edition, Philadelphla: Lippincott Williams&Wilkins. 2012; P. 1688-1718.
7. Rovira C and Biarnes X. Structure Energy relations in Methylcobalamin withand without bound axial base. Inorg Chem 2004; 43(21): p 6628-32.
8. Takahashi-Iniguez T, Garcia-Hernandez E, Arreguin-Espinosa R, Flores MERole of Vitamin B12 on Methylmalonyl-COA mutase activity. J Zhejiang Univ Sci B. 2012 June; 13(6): 423-437.
9. Ballington and DA Laughlin MM. Water Soluble Vitamins. In: Pharmacologyfor Technicians Workbook. 3 edition. New Delhi: CBS Publishers;2006.p. 510-511.
10. Yamatsu K, Yamanishi Y, Kaneko T, Ohkawa 1, Zasshi NY, Effects ofMethylcobalamin on mítosis of Schwann cells and incorporation oflabeled amino acid into protein fractions of crushed, sciatic nerve in rats. Folia Pharma Jpn, 1976; 72(2); 269-78.
11. Chmielnicka J and Nasiadek M. The trace elements in response to Lithiumintoxication in renal failure. Ecotoxicol Environ Saf. 2003; 55(2): 178-83.
12. Tamaddonfard E, Samadi F, Egdami K. The effects of vitamin B12 and their combination on cold and mechanical allodynia in a neuropathic painmodel in rats. Veterinary Research Forum. 2013; 4 (1) 19-24.
13. Kaidanovich-Beilin O and Woodgett JR. GSK-3: Functional insights from cellbiology and animal models. Front Mol Neurosci, 2011; 4(40): 1-19.
14. Okada K, Tanaka H, Temporin K, Okamoto M, Kuroda Y, Moritomo H, MuraseT, Yoshikawa H. Methylcobalamin increases Erk1/2 and Akt activitiesthrough the methylation cycle and promotes nerve regeneration in a ratsciatic nerve injury model. Exp Neurol, 2010; 222(2):191-203.
15. Ganesan B, Anandan R, Lakshmanan PT. Studies on the protective effects ofbetaine against oxidative damage during experimentally inducedrestraint stress in Wistar albino rats. Cell Stress Chaperones. 2011;16(6): 641-52.