CEREBRAL SMALL VESSEL DISEASE – LONGITUDINAL 10 YEARS EVIDENCED STUDY

ABSTRACT

Cluster of geriatric health issues which can lead to many neurodegenerative disorders including Parkinson's disease, Alzheimer's, and dementia. All these carry along with a potential decline in Quality of life, health care expenses; larger amount of disability. An early identification of risk factors, along with treatment using due medication coupled with non – pharmacological treatment using physiotherapy were analysed with evidence in a Ten year follow up of a subject with cerebral small vessel disease. Outcome of the research can be beneficial for geriatric subjects and to further continual of the findings of the research.

KEY WORDS:

CSVD – Cerebral small vessel disease

QOL – Quality of life

ADL – Activities of daily living

NPRS – Numerical pain rating scale

INTRODUCTION

An increasing longevity found to be associated with various health ailments. Especially geriatric subjects vulnerable to psychosocial, physical, financial issues leading to a diminished dignity, larger dependence and different degrees of disabilities. Systemic illness like hypertension, diabetic, atherosclerosis, can along with genetic factors play a vital role on global geriatric subjects developing neurodegenerative disorders like stroke, parkinsons disease, cognitive decline, psychiatric disorders, Alzheimer's. As these neuro ailments found to be linked with long term health care affecting subject, family and society. Early identification of risk factors and treatment of that were to be more focused medically. Another key factor from literature recorded were an early onset of these said risk factors can more be critical on living days of affected subject.

One among the pathological manifestations of Neurodegenerative disorders were vertigo, cerebral small vessel disease especially among subjects above 60 years. This research where

non – pharmacological ways with specific physiotherapy were discussed using evidence on geriatric female on a longitudinal analysis from 2011 – 2021.

AIMS AND OBJECTIVES:

1. To understand the pathogenesis of vertigo
2. To find role of physiotherapy as a prophylactic therapeutics.

MATERIALS AND METHODOLOGY:

Mrs. xxxx aged 68 years known hypertensive, Mesomorph Complaint of chronic neck pain with Vertigo was treated with Tablet Vertin and NSAID since 2010; subsequently NMRI taken in 2011 has shown small vessel disease.

The Author was treating her since 2011 with cervical spine strengthening, shoulder bracing along with core strengthening exercises and Inversion therapy weekly twice of 20 to 30 minutes duration from May 2011 to December 2021.

Meanwhile, her HbA1C has gone from 6 in 2011 to 7.5 in 2013 and 7 in 2021.

She was tested positive for Covid 2019 in July 2020, recovered with rest and medical care. In December 2021 on evaluation she had an increased tone of both extremities, upon reference to physician, she was treated with Tablet Pregabantin.

CLINICAL PROGNOSIS AND RESULTS:

Major functional problems faced by this research subject was Neck pain, dizziness who has retired from Government service and mother of two adult girls became a widow at the age of 76 years.

She was treated for hypertension and diabetes, but mesomorph. She was infected with SARS Covid 19, developed cerebral hypoxia was medically treated.

Along with medication for Hypertension and Diabetes Mellitus, she was regularly treated with twice a week physiotherapy and her functional prognosis were analysed along with from 2011 till December 2021.

She is functionally independent for ADL, daily care and financial needs.

Pain, stiffness of shoulders, knee pain (Right) with occasional dizziness recorded.

Cognitively doing good as she was found to independently living with a good life style.

TABLE 1. RESULTS ON NPRS,HBA1C, KATZ, FAZEKELS SCALE

YEARS	SCALES ON NPRS	HbA1c	KATZ INDEX ON ADL	FAZEKELS SCALE ON CSVD
2011	8	6		
2021	2	7		
PROGNOSIS	Has not taken MRI			

DISCUSSION

Critical Research Questions arising:

I. Does Vertigo give a clue for SVD

Vertigo were thought to be related to cardiovascular predictor; Few researchers have related dizziness among elders with CSVD leading to neurodegenerative disorders.

Toker et al 2008 in a systematic review from 1,506 citation and 5 studies vertigo could be a predictor for cardiovascular diagnosis. Whereas this research does not give any known history or complained of cardiac ailment, but a hypertensive and on medication. Further*Fatahzadehet al 2006* in clinical classification of including stroke and Transient ischemic attack to be cardiovascular diseases, which supports this subject having had single vessel disease as shown in her NMRI with vertigo for which she was treated but SVD was not treated with medication.

Cerchiai et al 2017 with ENT and Neurological experts from Italy have shown a link between cerebral small vessel white matter disease with Dizziness among geriatric subjects. SVD further can give rise to cognitive decline *(De Groot 2002)* dementia *(Tavera 2016)* and Falls *(Sibolt 2014).*

II. Role of physiotherapy here?

Karlberg et al 2004 theorized that parts of the vestibular system are differentially susceptible to global drops in pressure leading to ischemia (Billet et al 1989). Further *Newman et al 2008* have added strength (this research subject having vertigo and cerebral ischemic changes) that a global reduction in blood pressure lead to local asymmetries in vestibular system causing vertigo via a Transient ischemic attack type mechanism.

Tan et al 2017, recorded hypertension, diabetes mellitus and genetics to be associated with Arteriosclerosis, aging hence called hypertensive SVD *(TerTelgte 2018).*

An impaired auto regulation of involved small vessel results in reduced cerebral blood flow and chronic cerebral hypoperfussion.

Rigsby et al 2007 have noted in male hypertension rats spironolactone to improve tone of cerebral vasculature.

Rensma et al 2018 in a systematic review risk factors such as hypertension, diabetes mellitus, smoking, dyslipidemia, infection, heredity diseases, obesity, homocystenine concentration for CSVD.

Pantoni 2010 with neuro imaging of CSVD involving lacunar infarcts, subcortical infarct with micro bleeds, brain atrophy and enlarged perivascular spaces.

While research studies have identified hypertension, diabetics to be associated with CSVD, this research subject with being hypertensive and a diabetic along with vertigo more vulnerable to develop ischemic changes of neurological higher centers.

Her NMRI revealed at her age of 60 years with vertigo has shown CSVD with cortical atrophy.

III. Is there a link with hypertension age?

Li et al 2018 have stated main clinical manifestations of CSVD include stroke, cognitive decline, dementia, psychiatric disorders, abnormal gait and Urinary incontinence.

Petty et al 2000, 25% of all ischemic stroke from SVD, puts patients with twice the risk for SVD *(Warldlow et al, 2013).*

Leading cause of functional loss, cognitive decline and disability in elders.

Subtle gait and postural abnormalities were recorded among SVD subjects *(Ahmad et al, 2016).*

BPPV *(Bhatacharya et al 2017)* to be prevalent among 9 % elders can reduce ADL and depression.

Vestibular rehabilitation programs were shown to be effective *(Herdman 2013).*

Gait and posture can get altered in CVSD which are physical components involved.

Pinkhardt et al 2014 recorded Occulomotor and cognitive functioning probably depend more on which fibers are hit by SVD than amount of fibers affected.

White matter lesions burden positively correlates with age *(Okroglic et al 2013)* as SVD is linked with development of geriatric syndrome *(Kuo et al 2004).*

Dizziness Handicap Inventory Questionnaire *(Jacobson et al 1990).*

SVD burden based on Fazekas scale *(Fazekas et al 1999).*

White matter hyper intensities on T2 weighted on MRI are the radiological expression of SVD and known marker of a higher risk cerebral, cerebellar and brainstem stroke *(Fazekas et al, 1993).*

Una et al 2021 on holistic approach in the clinical management of CSVD.

This research subject was found to have in the last ten years independant for ADL, reasonable cognitive abilities going for regular walking for 30 minutes weekly five times.

Having infected with SARS Covid -19, she has recovered with bilateral hypertonicity (could be cerebral hypoxia) but with good functional recovery. She was complaining of stiff neck, shoulders which were treated with physiotherapy.

With regular adherence to specific physiotherapy findings of this longitudinal research can be vital for larger RCTs as a prophylactic therapy for CSVD.

With infrequent complaints with knee pain, LBA were treated with specific physiotherapy and VD3 supplements.

As shown in Table of Results NPRS reduction but glycemic control varying but functionally independent for all his daily activities were worthy noting.

CONCLUSION

Lesser focused were geriatric research, but as it necessitates their right to lead their life well, prophylactic means where especially with physiotherapy, a non – pharmacological means can along with due treatment with medication can be a boon in elderly care with an increasing elders worldwide, this unfocussed area of preventing neurodegenerative disorders gets more highlighted in this ten years of longitudinal follow up and Analysis with due evidence from 2011 – 2021.

Further studies on other measurable variables such as NMRI, specific parameters like gait, including other disciplines into the research are highly recommended.

REFERENCES

1. Newman-Toker, D. E., Hsieh, Y. H., Camargo, C. A., Jr, Pelletier, A. J., Butchy, G. T., &Edlow, J. A. (2008). Spectrum of dizziness visits to US emergency departments: cross-sectional analysis from a nationally representative sample. *Mayo Clinic proceedings*, *83*(7), 765–775.
2. Fatahzadeh, M., & Glick, M. (2006). Stroke: epidemiology, classification, risk factors, complications, diagnosis, prevention, and medical and dental management. *Oral surgery, oral medicine, oral pathology, oral radiology, and endodontics*, *102*(2), 180–191.
3. Karlberg J, Chong DSY, Lai WYY (2004) Do men have a higher case fatality rate of severe acute respiratory syndrome than women do? Am J Epidemiol 159:229–231.
4. Newman-Toker, D. E., Dy, F. J., Stanton, V. A., Zee, D. S., Calkins, H., & Robinson, K. A. (2008). How often is dizziness from primary cardiovascular disease true vertigo? A systematic review. Journal of general internal medicine, 23(12), 2087–2094.
5. Cerchiai, N., Mancuso, M., Navari, E., Giannini, N., &Casani, A. P. (2017). Aging with Cerebral Small Vessel Disease and Dizziness: The Importance of Undiagnosed Peripheral Vestibular Disorders. Frontiers in neurology, 8, 241.
6. Jan Cees De Groot; Frank-Erik De Leeuw; MatthijsOudkerk; Jan Van Gijn; Albert Hofman; JellemerJolles; Monique M. B. Breteler (2002). Periventricular cerebral white matter lesions predict rate of cognitive decline. , 52(3), 335–341.
7. Truswell, D. &Tavera, Y. An Electronic Resources Handbook for CNWL Memory Services. Dementia information for Black, Asian and minority ethnic (BAME) communities, Central and North West London NHS Foundation Trust, Feb. 2016.
8. Sibolt, G., Curtze, S., Melkas, S., Pohjasvaara, T., Kaste, M., Karhunen, P. J., Oksala, N. K., Strandberg, T., &Erkinjuntti, T. (2014). White matter lesions are associated with hospital admissions because of hip-fractures and trauma after ischemic stroke. Stroke, 45(10), 2948–2951.
9. Li, Q., Yang, Y., Reis, C., Tao, T., Li, W., Li, X., & Zhang, J. H. (2018). Cerebral Small Vessel Disease. Cell transplantation, 27(12), 1711–1722.

10. Petty, G. W., Brown, R. D., Jr, Whisnant, J. P., Sicks, J. D., O'Fallon, W. M., &Wiebers, D. O. (2000). Ischemic stroke subtypes : a population-based study of functional outcome, survival, and recurrence. Stroke, 31(5), 1062–1068.
11. Wardlaw, J. M., Smith, E. E., Biessels, G. J., Cordonnier, C., Fazekas, F., Frayne, R., Lindley, R. I., O'Brien, J. T., Barkhof, F., Benavente, O. R., Black, S. E., Brayne, C., Breteler, M., Chabriat, H., Decarli, C., de Leeuw, F. E., Doubal, F., Duering, M., Fox, N. C., Greenberg, S., … STandards for ReportIng Vascular changes on nEuroimaging (STRIVE v1) (2013). Neuroimaging standards for research into small vessel disease and its contribution to ageing and neurodegeneration. The Lancet. Neurology, 12(8), 822–838.
12. Tan, C. S., Hassali, M. A., Neoh, C. F., &Saleem, F. (2017). A qualitative exploration of hypertensive patients' perception towards quality use of medication and hypertension management at the community level. Pharmacy practice, 15(4), 1074.
13. TerTelgte, A., van Leijsen, E., Wiegertjes, K., Klijn, C., Tuladhar, A. M., & de Leeuw, F. E. (2018). Cerebral small vessel disease: from a focal to a global perspective. Nature reviews. Neurology, 14(7), 387–398.
14. Rigsby, C. S., Burch, A. E., Ogbi, S., Pollock, D. M., &Dorrance, A. M. (2007). Intact female stroke-prone hypertensive rats lack responsiveness to mineralocorticoid receptor antagonists. American journal of physiology. Regulatory, integrative and comparative physiology, 293(4), R1754–R1763.
15. Rensma, S. P., van Sloten, T. T., Launer, L. J., &Stehouwer, C. (2018). Cerebral small vessel disease and risk of incident stroke, dementia and depression, and all-cause mortality: A systematic review and meta-analysis. Neuroscience and biobehavioral reviews, 90, 164–173.
16. Pantoni L. (2010). Cerebral small vessel disease: from pathogenesis and clinical characteristics to therapeutic challenges. The Lancet. Neurology, 9(7), 689–701.
17. Zekri, Hamid; Mokhtari, Ahmad Reza; Cohen, David R. (2016). Application of singular value decomposition (SVD) and semi-discrete decomposition (SDD) techniques in clustering of geochemical data: an environmental study in central Iran. Stochastic Environmental Research and Risk Assessment, 30(7), 1947–1960.
18. Bhattacharyya, N., Gubbels, S. P., Schwartz, S. R., Edlow, J. A., El-Kashlan, H., Fife, T., Holmberg, J. M., Mahoney, K., Hollingsworth, D. B., Roberts, R., Seidman, M. D., Steiner, R. W., Do, B. T., Voelker, C. C., Waguespack, R. W., & Corrigan, M. D. (2017). Clinical Practice Guideline: Benign Paroxysmal Positional Vertigo

(Update). Otolaryngology--head and neck surgery : official journal of American Academy of Otolaryngology-Head and Neck Surgery, 156(3_suppl), S1–S47.

19. Hall, C. D., Herdman, S. J., Whitney, S. L., Cass, S. P., Clendaniel, R. A., Fife, T. D., Furman, J. M., Getchius, T. S., Goebel, J. A., Shepard, N. T., & Woodhouse, S. N. (2016). Vestibular Rehabilitation for Peripheral Vestibular Hypofunction: An Evidence-Based Clinical Practice Guideline: FROM THE AMERICAN PHYSICAL THERAPY ASSOCIATION NEUROLOGY SECTION. Journal of neurologic physical therapy: JNPT, 40(2), 124–155.
20. Pinkhardt, E. H., Issa, H., Gorges, M., Jürgens, R., Lulé, D., Heimrath, J., Müller, H. P., Ludolph, A. C., Becker, W., &Kassubek, J. (2014). Do eye movement impairments in patients with small vessel cerebrovascular disease depend on lesion load or on cognitive deficits? A video-oculographic and MRI study. Journal of neurology, 261(4), 791–803.
21. Okroglic, S., Widmann, C. N., Urbach, H., Scheltens, P., &Heneka, M. T. (2013). Clinical symptoms and risk factors in cerebral microangiopathy patients. PloS one, 8(2), e53455.
22. Hsu-KoKuo, Lewis A. Lipsitz, Cerebral White Matter Changes and Geriatric Syndromes: Is There a Link?, The Journals of Gerontology: Series A, Volume 59, Issue 8, August 2004, Pages M818–M826.
23. Jacobson, G. P., & Newman, C. W. (1990). The development of the Dizziness Handicap Inventory. Archives of otolaryngology--head & neck surgery, 116(4), 424–427.
24. Fazekas F, Kleinert R, Roob G, Kleinert G, Kapeller P, Schmidt R, et al. Histopathologic analysis of foci of signal loss on gradient-echo T2-weighted MR images in patients with spontaneous intracerebralhemorrhage: Evidence of microangiopathy-related microbleeds. AJNR Am J Neuroradiol. 1999;20:637–42.
25. Una, C., et al. (2021) Clinical management of cerebral small vessel disease: a call for a holistic approach. Chinese Medical Journal.