Extended Abstract
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Brain Disorders: Multiple Sclerosis, corpus callosum and bedside test- Khin Maung Bo- Northern Lincolnshire and Goole NHS Foundation Trust

Khin Maung Bo

Northern Lincolnshire and Goole NHS Foundation Trust, UK

Abstract

Demyelination affects highly myelinated structures like corpus callosum (CC). CC is exclusive in function that it connects right and left brain and it synchronises bimanual or bipedal activities. Affecting CC can disturb synchrony between the 2 hemispheres and can affect bimanual and bipedal tasks. The aim is to ascertain if speed of clapping (bimanual activity) can reflect the involvement of CC in MS. Succeeding 70 multiple sclerosis patients from outpatient clinics and home visits were tests for bimanual hand function (clapping). Exclusion criteria are upper limb power MRC scale, pain, visual impairment, intentional tremors, stroke or cognitive impairment. Study period started from 01.09.2016. Comparison of speed between rapid supination/pronation of left and right separately then clapping of both hands (supination/pronation of every hands alternatively) were conducted. Patients had to try to as fast as they might and noticeable slowing of clapping comparing to single hand supination/pronation was taken as a symbol slowing down of conduction through CC. 31 patients were excluded, 34 patients showed no noticeable difference, 2 patients were difficult to make conclusions and 3 patients showed definite slowing down in clapping. Positive patients will have difficulties in doing bimanual activities like using two sticks for mobility, typing using keyboard, and pushing wheel chair bimanually etc. It is possible to detect CC involvement by doing above bedside test and may be utilized in rehabilitation setting. Sample size isn't large enough and bigger studies got to follow to validate the finding.

Background: The main feature of Multiple Sclerosis (MS) is demyelination which slows down the conduction of Axons in the Central Nervous System. All the signs and symptoms of MS are result of this feature. Corpus Callosum (CC) is one of the biggest myelinated structures in the brain and often involved in the demyelination process.

Objectives:

1. To develop a bedside test that reflects CC involvement in MS and tests it on MS patients

2. To work out prevalence of positive CC bedside test in MS sufferers

Methods: Clapping with alternative supination/pronation needs synchronisation of both hemispheres through CC. This will be used as a bedside test reflecting integrity of CC. The speed of clapping is compared with the speed of single hand shakings. 70 consecutive patients, suffering from MS, were seen in clinics and home visits starting from 01 09 2016. Exclusion criteria were Upper limb strength MRC scale, Impaired position sense in the upper limbs, Pain including neuropathic sensation, visual impairment, Stroke, Cognitive impairment, intentional tremor, muscular-skeletal conditions affecting hand movement and movement disorder involving upper limb(s).

Results: Out of 70 patients, 31 patients were excluded, 34 patients showed no difference in the speed between the clapping and single hand shaking and 3 patients showed noticeable difference between the clapping and single hand shakings. Comparison of CC thickness on MRI scan between three positive patients and three negative matched patients clearly showed marked thinning of CC within the three positive patients.

Conclusions: The study showed at 4.2% of the patients showed dyes synchronisation of the hand movements (clapping) all of whom showed marked thinning on MRI scans.

Introduction: Corpus Callosum (CC) is the structure that connects both hemispheres in both directions. If there is deficiency in the connection, there will be dyssynchronisation in bimanual and bipedal activities. There is a bedside sensory test for CC developed by Kazuo Satomi. Sensory tests are not generally applicable in MS as many of the MS sufferers have variety of sensory impairments. Motor bedside test would be more appropriate and the author has designed the motor test for upper limbs.

Findings: 3 (4.2%) patients showed noticeable slowing of speed of clapping and two patients finding were questionable due to functional overlay, 34 (48%) patients showed no noticeable difference in the speed of hand shakings and clapping. It is difficult to determine in 2 patients (3%) due to functional overlay. MRI images of the three positive patients

were then reviewed. Thinnest segments of their CC were measured. The three positive patients were then matched with three negative patients from the sample (age & duration of MS) for comparison. The average thickness of CC in positive patients is 2.1mm and for the three matched negative patients is 3.6mm. The finding support that there is correlation between thickness of CC and dys-synchrony between the two sides

Representativeness of the Sample: Sample Frame was taken from filing cabinets. There were 367 MS patients under our team caseload which covers North Lincolnshire and Northeast Lincolnshire in UK (Total population 329420 in 2015). There are two outliers (Age 18 & 87) in the Sample Frame and they are excluded to match the Sample. Sample Frame is now 365. Mean age of Sample Frame is 55.56 as shown in the Age Distribution Graph. Maximum Prevalence is between 50 to 59 years. Female to Male ratio of Sample Frame is 2.04. In the sample, Female to Male ratio is 2.18. Age range is from 20 to 74 with the mean age of 55.5. Maximum prevalence is between 50 to 59 years Both Graphs are Negative Skewed as Maximum Prevalence is between 50 to 59 in both Sample and Sample Frame. Although Sample size is only 19% of Sample Frame, it is found to be representative of the Sample Frame.

Extension study: As an extension of the above study, further sampling was taken from clinics and home visits in July, August and September 2017. All the exclusion criteria from the first study still applied. In addition, the patients must not be from the first sample and their MRI scans must be accessible and the measurement of thinnest segment must be greater than 2.5mm (the author have arbitrarily chosen 2.5 mm thickness a cut-off point as the average CC of positive patients from the first study is 2.1mm). MRI scans were reviewed the day before the clinic, and bedside clapping test was performed in clinics or home visits the next day

Finding of Extension Study: There were 17 MS patients who met the criteria and none of the patients showed dys-synchrony in Bedside Clapping Test.

Conclusion of the Extension Study: The finding showed that if the CC is thick enough (>2.5mm), synchrony of bimanual activity is intact.

Discussion: Dys-synchrony of bimanual activity like clapping reflects dyssynchrony between the two hemispheres which reflects CC deficiency unless proven otherwise. MRI scan measurements support the correlation between the thinness of CC and dys-synchrony of left and right in bimanual activities. The author also has video evidence of how these positive patients struggled to do clapping despite being strong enough upper limbs (at least 4/5 MRC scale) which has never seen before until the author looked for it. The author has experienced with hundreds of neurological patients with a variety of neurological conditions in the last twenty years. Although MS can have complex manifestation of signs and symptoms, CC deficiency can cause specific clinical sign (another example of dys-synchrony is observed in Intern clear Opthalmoplegia where the deficiency lies in Medial Longitudinal Fasciculus and this was accepted without Imaging or Neurophysiology evidence)

Note: This work is partly presented at 5th International Conference on Brain Disorders and Therapeutics Madrid, Spain.