

Comparison of Vestibular Function Between Right and Left Handed Normal Population

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ABSTRACT

Objective To identify the side of vestibular dominance in right handed & left handed people.

Method A total of 50 normal subjects, aged between 15 - 45 years were included as Left handers (n = 25) and Right handers (n = 25). Handedness was confirmed by the Annett Hand Preference Questionnaire. Bithermal caloric testing was done which was recorded by Electronystagmography (ENG). Maximum Slow Phase Velocity (MSPV) was taken as the parameter of choice. Directional Preponderance (DP) and Canal Paresis (CP) were calculated in each group.

Results Out of the 25 Left handed subjects, 8 had DP towards Left whereas 7 had DP towards the Right and the remaining 10 showed no DP to any side (normal) ($p < 0.001$). Out of the 25 Right handed subjects, 4 had DP towards Right and none had DP towards the Left, remaining 21 showed no DP to any side (normal) ($p < 0.001$). For CP, out of 25 Left handed subjects, 2 showed CP towards the Left and 1 towards the Right, the remaining 22 showed no CP (normal) at all. Similarly out of the 25 Right handed subjects, 2 showed CP towards the Left and 1 towards the Right, the remaining 22 showed no CP (normal) at all. Out of 25 Right handers, it was found that Right handers showed Right vestibular preference whereas vestibular preference was almost equally distributed to Left and Right side in Left handers.

Conclusion On considering DP, it was found that Right handers showed Right vestibular preference whereas vestibular preference was almost equally distributed to Left and Right side in Left handers ($p < 0.001$).

Key words: Bithermal caloric test, directional preponderance, electronystagmography, handedness, vestibular dominance

INTRODUCTION

The Vestibular system is the system of balance and equilibrium. It is a distinct sensory organ comprising of three semicircular canals, which are sensitive to angular accelerations, and two otoliths (utricle and saccule), which are sensitive to linear accelerations. Each semicircular canal is approximately at right angles to the other two¹.

The vestibular system's main function is to sense head movements, especially involuntary ones, and counter them with reflexive eye movements and postural adjustments that keep the visual world stable and keep us from falling². Handedness is the natural or biological preference for using one hand more than the other in performing special tasks

depending on dominant hemisphere. As handedness is biologically and genetically linked, so it has various effects on one's behavior and abilities. The reason is that right handers have genes that force their brains into a slightly more one sided structure but brains of left handers are more symmetric where the two sides are more equal which enhances person's abilities³.

As stated above, functional asymmetries occur in right-handers as compared to left-handers who show a more symmetrical organization resulting in less asymmetry in sensorimotor tasks performed with the left or right hand. Present study was done to establish difference in the dominance of vestibular responses in normal left and right handers respectively in our region.

MATERIALS AND METHODS

It was a descriptive observational study conducted in Nepalgunj Medical College Teaching hospital, Kohalpur from 1st December 2014 to 30th November 2015. Total sample size was 50 out of which 25 subjects in each two groups of left and right handed normal population were divided to compute the vestibular dominance. Subjects with in age group of 15-45yr without any complaints of vestibular disorder with normal functioning ears and eyes were included in this study. Subjects

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having CNS diseases, mixed handedness were excluded.

Handedness was assessed using the forced-choice hand preference questionnaire by Annett⁴ which is as follows: asking the participants to indicate the hand he/she usually uses to carry out 12 unimanual everyday actions like throwing, use of scissors, comb, toothbrush, knife, spoon, hammer, screwdriver, strike a matchstick and threading a needle, which yields a laterality quotient that ranges from -100 (totally left-handed) to +100 (totally right-handed). A cut-off score of ≤ -60 on this questionnaire was used to classify the individuals as left-handers and a score of $\geq +60$ as right-handers. Intermediate scores indicate mixed-handers. According to this criterion all participants were attributed as either dominantly left- or right-handed.³

Clinical Vestibular Function Test like Spontaneous nystagmus, Fistula test Romberg test, Gait, Past-pointing and Falling, Dix-Hallpike maneuver, Fukuda's writing test were done. Bi-thermal Caloric Test (Hallpike-Fitzgerald) using ENG was done. The electrodes were applied 1.5 cm lateral to outer canthus on both sides (to record horizontal eye movement), 1.5 cm above as well as below the eye on one side (to record vertical eye movement) and the neutral (ground) electrode on the glabella of forehead. Two polythene catheters [Feeding tube (size 6 Fr)] were introduced; one in each external auditory canal,. The quantity of water used for caloric test was 50 cc taken in a 50 ml syringe over a time period of 40 seconds. Irrigation was done in the order 44° right, 44° left, 30° left, 30° right. The interval of at least 5 minutes was maintained between two successive irrigations. Recording was started immediately at the start of the irrigation and continued for two and half minutes to three minutes.

Subject was asked to move his/her eyes 20° to the left and right looking at the light bar with LEDs which was placed 1 meter away from the patient. The sensitivity of the machine was so adjusted that 10° ocular movement produced 10 mm deflection of the recording needle on the vertical axis and 10 mm on the horizontal axis was equal to 1 second time duration. Upward deviation was caused by looking to the right and looking upwards while downward deviation was caused by looking to the left side and looking downward. The data was then analyzed by the computer and MSPV was calculated by the same. The normal ranges for maximum slow phase velocity were kept as follows:

Right warm = 4 – 18° / second Right cold = 4 – 19° / second
 Left warm = 5 – 20° / second Left cold = 5 – 21°/second

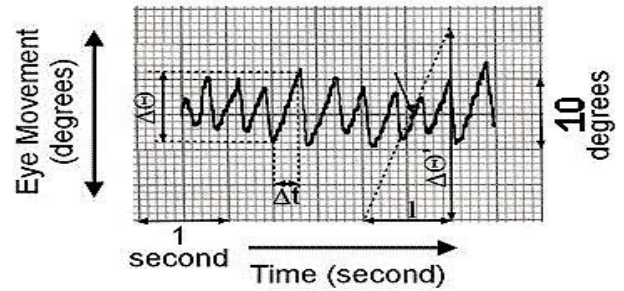


Figure 1: Graph showing calculation of SPV

Result was given as MSPV of Right warm, Right cold, Left warm, Left cold. Directional Preponderance and Canal Paresis was then calculated by using the formula below:

Directional Preponderance (DP)	Canal Paresis (CP)
$(RW+LC) - (RC+LW)$	$(RC+RW) - (LC+LW)$
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$\times 100 (\%)$	$\times 100 (\%)$
$[RC + RW + LC + LW]$	$[RC + RW + LC + LW]$

The normal values for DP and CP were kept as follows:

Directional Preponderance	Canal Paresis
Right sided > 20	Right sided < - 20
Left sided < - 20	Left sided > 20
Normal + 20 to - 20	

RESULTS

The age of the subjects ranged from 15 years to 45 years of age with mean age of 27.6 years. Most of the subjects were within 26-30 years (42%). The next common age group was 21-25 years (24%). Out of 50 patients, 68%(34) were males and 32%(16) were females.

There were 25 Left handed and 25 Right handed subjects. Fukuda's writing test was carried out in both Right and Left handers each using both of their hands. However no abnormality was detected in any of the subjects.

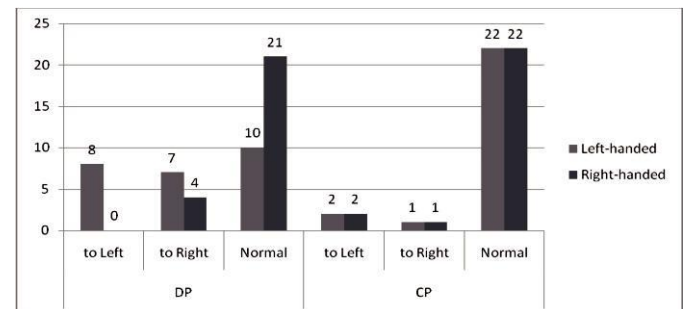


Figure2: Directional Preponderance and Canal Paresis of all subjects

Out of the 25 Left handed subjects, 8 had DP towards Left whereas 7 had DP towards the Right and the remaining 10 showed no DP to any side (normal). Out of the 25 Right handed subjects, 4 had DP towards Right and none had DP towards the Left, remaining 21 showed no DP to any side (normal).

For CP, out of 25 Left handed subjects, 2 showed CP towards the Left and 1 towards the Right, the remaining 22 showed no CP (normal) at all. Similarly out of the 25 Right handed subjects, 2 showed CP towards the Left and 1 towards the Right, the remaining 22 showed no CP (normal) at all.

While evaluating the relationship between DP and handedness, it was found to be at p value of < 0.001 , which is statistically highly significant. Then the relationship of DP between Left and Right handers was also tested which was found to be statistically significant as well with a p value of < 0.001 .

However the relationship between CP and handedness was also tested and was found to be at p value of 1.0. The relationship between CP and Right and Left handedness was also found to be at a p value of 1.0.

A correlation between DP and CP was tested which was found to be at p value of 0.001.

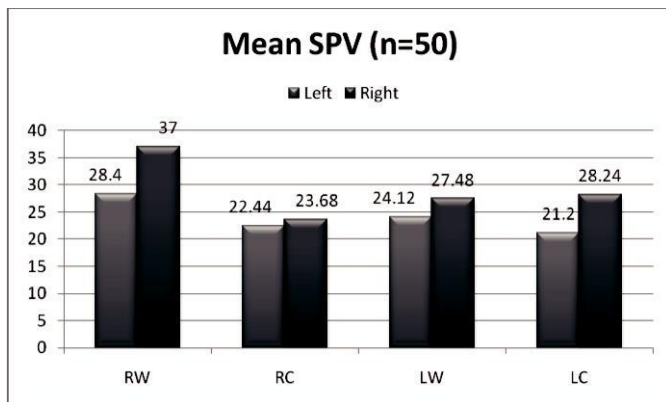


Figure3: Mean SPV of both Right and Left handed subjects

The above figure shows the mean SPV of both the Right and Left handed subjects in all the 4 caloric test parameters. It shows a mean of 28.4 in RW, 22.44 in RC, 24.12 in LW and 21.2 in LC in the Left handed subjects. On the other hand, it shows a mean of 37 in RW, 23.68 in RC, 27.48 in LW and 28.24 in LC in the Right handed subjects.

DISCUSSION

In present study, Directional Preponderance has been used to

determine the vestibular dominance in comparison to handedness. Out of 25 Left handed subjects, 8 (32%) showed DP towards Left and 7 (28%) showed DP towards Right and 10 were normal. This showed that in Left handers similar percentage of subjects demonstrated DP towards both Left and Right.

Likewise, out of 25 Right handed subjects 4 (16%) showed DP towards Right side whereas none showed DP towards Left side and 21 were normal.

The above data shows that there is a difference in DP between right and left handers ($p < 0.001$). In Right handers it only existed towards the Right side, whereas in Left handers, some demonstrated DP towards Left whereas others to the Right. Thus it demonstrated that Right handers showed Right vestibular preference whereas vestibular preference was almost equally distributed to Left and Right side in Left handers. In present study, CP was seen towards Left in 2 (8%) and towards Right in 1 (4%) in both right and left handed groups whereas 22 (88%) in each group were normal. The above data shows that there is no difference in CP between right and left handers ($p = 1.0$).

CONCLUSION

In the present study, 50 subjects were included out of which 25 were Left handers and 25 were Right handers (as confirmed by the Annett Hand Preference Questionnaire). Bithermal caloric testing was done which was recorded by ENG. MSPV was taken as the parameter of choice and DP and CP were calculated in each. On considering DP, it was found that Right handers showed Right vestibular preference whereas vestibular preference was almost equally distributed to Left and Right side in Left handers ($p < 0.001$).

However no difference in sensitivity between right and left handers was noted ($p = 1.0$).

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