~~LIST OF PROCEDURES DONE~~

PROJECT REPORT

TITLE OF THE PROJECT: A STUDY OF CEREBRAL DOMINANCE IN CHILDREN AND YOUNG ADULTS WITH NORMAL VISCERAL SITUS

NAME..... DR. SANJEEV V. THOMAS .....

PROGRAMME: D.M. NEUROLOGY RESIDENT

MONTH & YEAR OF SUBMISSION: NOVEMBER 1988.

SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES AND TECHNOLOGY, TRIVANDRUM 695011

Name	
Page	of
Date	

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CERTIFICATE

I, Dr. Sanjeev V. Thomas.....hereby declare that I have actually ~~performed all the procedures listed~~/carried out the project under report.

Signature.....

Place: Trivandrum,

Name in... DR. SANJEEV V. THOMAS

Date: 12.II.1988. capital letters

CERTIFICATE

Certified that the work done in the project entitled "A STUDY OF CEREBRAL DOMINANCE IN CHILDREN AND YOUNG ADULTS WITH NORMAL VISCERAL SITUS" has been carried out by Dr.Sanjeev V.Thomas himself under my guidance and supervision.

14.11.88

DR.P.K.MOHAN MD., DM.

Assoc.Prof.and Head of Department
of Neurology
SCTIMST-TRIVANDRUM

Title of the project:- A study of Cerebral Dominance in children and young adults with normal visceral situs.

Duration - 6 months.

Aim and Scope - To study the pattern of Cerebral Dominance for hand, leg, eye and ear the given polulation and to observe for any possible correlation between different organ dominance, between coarse movements and precision movements, and innate and acquired functional movements. Further to identify a few bedside tests to ascertain the cerebral dominance of a person in a clinical setting.

Summary - 20 subjects were studied for cerebral dominance using a battery of tests for hands legs, eyes and ears. The results were analysed in terms of tests for coarse movements, tests for precision movements and tests for time bound precision movements. A handful of bedside tests for cerebral dominance of these organs functioning are identified.

A STUDY OF CEREBRAL DOMINANCE IN CHILDREN AND YOUNG ADULTS WITH NORMAL VISCERAL SITUS.

DR. SANJEEV V. THOMAS

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AKNOWLEDGEMENT

I am thankful to Dr. P.K. Mohan M.D., D.M Head of the Department of Neurology for introducing to me this interesting field of Neurology and for the valuable guidance and suggestions throughout the course of this study.

I place on record my sicere thanks to the Head of the department of Cardiology and the Director of the Institute for permitting me to study the patients and utilise the institute facilities.

I am deeply indebted to the patients who gladly subjected themselves to the study as volunteers..

DR. SANJEEV V. THOMAS

Nov. '88.

GENERAL INTRODUCTION

Asymmetrical functions of brain and hemispheric specialisation had been the interest of scientists for more than 120 years. There is archaeological evidence, in the form of the tools of prehistoric man, and paintings, dating back to 2500 BC that human beings were using one hand preferentially for most of the activities. [1,2] Infact recent studies have shown that not only man, but lower species like rats and birds also show cerebral hemispheric lateralisations. [3] Numerous examples of similar asymmetry can be pointed out like movement of ciliated unicellular organisms, left hand helix of Z. DNA, l and d forms of organic chemical molecules and sub atomic particles. [3,5]

Asymmetric function of brain is more than an academic curiosity and goes a long way in lateralising function to either hemisphere and helps in precise localisation of the anatomical lesion in the event of a structrual damage. Also a new light is thrown in to the structrual basis of many developmental disorders like dyslexias, Further association between immunological disorders and

hemispheric dominance is also becoming more explicit. As a result of these additional data, the study of cerebral dominance has been extended from being a simple question of which hand you use in writing, to an elaborate evaluation of the preferential functioning of the extremities, eyes and ears. Undoubtedly all these were feasible mainly because of the advent of noninvasive investigations (CT Scan, MRI, PET etc) which yield the accurate informations regarding structure and metabolism. A brief outline of these data shall be followed by the presentation of the present study.

A GENERAL OUTLINE AND AIM OF THE STUDY

Cerebral dominance is not exclusively limited to lateralisation of speech and handedness. Each person has a preference for one leg over the other, one hand over the other one eye or ear over its counterpart. Besides a person may prefer one hand for simple activities and the other hand for more precise and fine movements.

The major objective of the present study was to investigate the preferential use of hands, legs, eyes and ears in a series of functions, some of them simple activities and those requiring precise coordination. Further, movements innate to the subject and learned movements were studied. Yet another purpose was to select a few simple bed side tests whereby a clinician can reliably assess the cerebral dominance of a patient. Attempts have also been made to ascertain any possible correlation between the cerebral dominance of different organs.

REVIEW OF LITERATURE

It is difficult to ascertain the cerebral dominance of a person for lack of absolute criteria. The incidence of left handedness varies between 1 percent and 30 percent according to different authors [6] (Table I).

Table I

Prevalence of left handedness according to different studies. Modified from Ref. 6

Author	Percentage
Hasse	1
Wallin	2.8
Chamberlain	4.34
Bersot	5.5
Trankell	8.2
Hect	12
Ramaley	15.7
MacNoughton-Jones	22
Wile	25 to 30

.....

Factors influencing Cerebral lateralisation

1. Age. The prevalence of right handedness is higher

in older persons when compared to younger persons. [6] Many authors feel that the handedness gets established by around 6 or 7 years of age.

2. Type of activity involved. According to Blau [6] depending on the type of test given, the right handedness among 532 adolescents (10-20 years of age) in a school population varied from 84.21% to 43.99%. The more differentiated and specialised the activity, the greater the dominance of the right hand. On the contrary chance distribution 50-50 is approached in case of the simplest activities [6]

3. Sex. Most of the studies report a relative increase in prevalance of left handedness among males [4,5,6] (Table II).

Table II (Modified from Ref 6)

Author	Left handedness %	
	Men	Women
Ogle	5.7	2.8
Clark	8	5.9
Baldwin	6.6	3.8
Bloede	5.75	6.25

Recent investigations have shown that the maturation of the left cerebral hemisphere is slower than the right and is kept under partial check by testosterone which is present in a higher concentration in male. This could explain this phenomenon [3.4.5]

4. Genetic Factors.

Most of the studies have clearly demonstrated an increased incidence of left handedness among certain families. Anatomical differences between the right and left hemispheres evident even in the foetus [3] are usually quoted as an evidence. Sylvian point on the right side is higher by 16th week of gestation. The planum temporale asymmetry is visible by 31st week of gestation. Asymmetries of the length of the hemispheres and lateral ventricles are also observable in the foetus. It appears that regions on the left side that will be larger in the mature brain develop more slowly than the corresponding areas on the right. Lateralised cerebral function has been identified in lower species also. Annet [7] has proposed that majority of the population has a right shift gene which directs the development of brain such that they eventually develop in to right handed persons. In the absence of such a gene (about 18% of the population) the development of brain is random with regard to cerebral dominance and

half of them become right handed and remaining half (9%) become left handed. About 2% of the offsprings of dextral parents will be left handed and this figure rises to 17% if one parent is sinistral and 46% if both are sinistral. [10]

5. Uterine and parturitional factors

Some investigations have observed a correlation between intrauterine foetal lie and the future handedness eg. Left occipitoanterior position and right handedness[5]. But the cause effect relationship of this is not proved.

6. Hormonal factors.

The role of testosterone in development of brain and its relationship to handedness in male [3,4,] had already been mentioned.

7. Neurologic disorders.

Learning disorders, dyslexias, stammering, epilepsy are a few conditions associated with left handedness. This aspect of cerebral lateralisation is discussed in detail in a recent article by N. Geschwind [3,4,5]

8. Other systemic disorders.

Studies conducted by N. Geschwind [4,5] et al., showed that immuno deficiency states were about 2½ times more in the

left handers as compared to right handers. This observation is corroborated with the fact that testosterone influences the development of immune system.

9. Other nongenetic factors.

Bodian has reported a higher rate of non right handers in males born from September through February ie. conceived from December through May. [4] Maternal age and parity are reported to influence the cerebral dominance of the offspring. [4] The higher incidence of left handedness among twin had been the source of many speculation in to the genesis of cerebrel dominance. [4.6,10]

10. Some associations of anomolous cerebral Dominance.

Meningiomas of the lateral ventricle, lupus erythematosis and congenital heart block are commoner in left handers. [4] Harelip, blond hair, scoliosis, Perthes disease, Klippel Feil syndrome and spina bifida are some other conditions associated with anomolous dominance.

11. Cultural and Social factors.

Various postulates ranging from breast feeding habits, the style by which a nurse carries one infant and warfare shield theory had been invoked to explain a person's handedness. But most of them are considered irrelevant in the light of

present day knowledge.

Pedal dominance Ocular dominance and aural dominance

Various authors have tried to correlate between the lateralisation of land, leg, eye, and ear functions. Hildreth [6] has noticed that dominance of left eye is more frequent than dominance of left hand (the percentage varying between 62 and 73 for dominance of Rt. eye, between 21 and 50 for left eye and between one and eight for dominance which is ambiguous. According to Bart [6] the eye-hand correspondence has a tendency to decrease with age.

Methods of Determining Right or Left sidedness

Innumerable methods are described for the detection of cerebral dominance which are of unequal value. They can be divided in to :

1. Those tests based on morphological and morpho-functional characteristics.
2. Questionnaire method about right and left sidedness.
3. Battery of tests of right and left sidedness and
4. Special methods.

I. Test based on Morphological and Morpho-functional Characteristics

(a) Anthropometric tests like length and circumference of the limbs, which could be the result rather than the cause for the preferred side.

(b) Peculiarities of venous net work of the hand

(c) Dermatoglyphic analysis.

(d) According to Henry Hecaen the morpho-functional tests are of greater importance. They include the analysis of the extensibility of joints and synkinetic movements of the hands.

II. Questionnaire regarding Right and Left sidedness.

Any number of parameters can be included this questionnaire and this readily makes available a large quantity of data for statistical analysis. But the main drawback is lack of objectivity. Some investigators have grouped these tests into those concerning learnt bimanual tasks, bimanual tasks not learnt, learned unimanual tasks, unimanual tasks not learnt and tasks not learnt and under handicap. The important thing is that a good test should include samples from all categories.

III. Tests of Right or Left sidedness.

These are objective tests carried out on a subject to decide his sidedness. Various authors have formulated

their own test batteries eg: Roudinesco and Thyss, Subirana Clark, Rey Zazzo et. al.[6] These include unimanual tests bimanual tests, tests for lower limbs eyes and ears; A few examples of them are quoted below:

Pricking across a plate with holes placing marbles in a bottle. Cutting out a circle, rolling a reel of thread, beading a string, dealing cards making a ball paper, picking up a ball, throwing a ball, catching a ball spontaneously, screwing and unscrewing the stopper of a bottle, mirror writing.

For the foot. Jumping, shooting a ball, working a pedal, the foot first introduced into trousers, the foot first put on a step of a staircase.

For the eye. Sighting, aiming with a pistol looking through a microscope, looking through a key hole, aiming at a point with both eyes, open, looking in to a box through a hole in the cover looking through a tube etc.

For the ear. Turn rapidly when one hears a sound, ear prefered in listening to the ticking of a watch, and dichotic hearing.

IV. Special Tests.

Several special tests are devised to objectively asses cerebral dominance. Phi test of Jasper[6] and Raney is used to detect ocular dominance and Van Ripers.[6]

Critical angle board is used to identify manual superiority. These tests are very cumbersome and are of dubious value. Electromyographic activities in the resting limb, while its counter part is activated and Wadda's tests are also popular. In Waada's test sodium amytal is injected in to the carotid arteries. The subject develops dysphasia inaddition to hemiplegia when the injection is made on the side of cerebral dominance for speech. He develops asomatognosia and unilateral neglect when injected on the side of cerebral dominance for visuospatial and body scheme functions.

Sensitivity and Specificity of the test.

A wide variation is observed in the result of these different test batteries. Some of the tests reflect the manual preferences while some others denote comparative skill and rapidity which explain partly such discrepancies. Similarly some tests are subject to the profound cultural and social influences on the subject. M.M.Clark [6] who was studied this aspect of cerebral dominance observed that (1) significiant correlation exists between the different manual preference test. She observed highest percentage of right sidedness in case of hand. (2) There was less correlation in case of eyes and least for ears. (3) Also there was no consistent relationship between the laterality of hand, leg, eyes and ears.

METHODOLOGY

Study Population

Twenty children admitted to the cardiology ward of the Institute formed the study population. Their age ranged from 6 to 20 years. Mean age I0.35 years. (Male I5 and Female 5) All of them had normal visceral situs and no neurological disorders. Children with congenital heart disease but normal visceral situs were selected to match the population of another controlled study of cerebral dominance in children with abnormal visceral situs and congenital heart diseases.

Test Setting

Two persons were given the tests at a time, each one sitting opposite other at a table. Height of the chair was adjusted to suit the convenience of the subject. First, each test was demonstrated and explained to the subject. (a) Tests for hand preference material was displayed in front of the subject equidistant from either hand, at equal facility for either hand. (b) A stop watch was used to accurately measure the time, wherever necessary. The first response of the candidate was recorded wherever side preference was involved. Dexterity of a movement was assessed by visual impression. Identical test material was given for all subjects.

A. Tests for Hand Preference

I. Card shuffling and dealing :- A set of playing cards is kept on the table in front of the subject and he is instructed to pick up the cards, shuffle and arrange them in four different groups. The hand preferred to take the cards, dexterity of shuffling and dealing are noted after repetition of the test with the opposite hand.

2. Cutting a circle out of a paper. A paper, on which a standard size circle is printed, and a pair of scissors were kept on the table close to each other. The subject was requested to take the scissors and cut out the circle precisely along the circle outline. The time taken to complete the task with either hand, the dexterity of cutting and the hand preferred to cut are noted.

3. Winding a thread on a reel. An empty reel and a long piece of thread are kept along side on the table. The hand preferred to pick up the thread and wind are noted. Subject is instructed to keep the reel stationary.

4. Threading beads on a rod. A set of 8 beads in a cup and a suitable thin rod are kept on the table. Subject has to pick up the rod and fix it firmly to the edge of the table and thread the beads one after the other with the opposite hand. The hand preferred and the time taken to complete the task with either hand are noted.

5. Clapping The hand which is kept above the other while clapping is noted.

6. Folding the arms across chest. Subject is instructed to keep the hands folded across the chest. The hand which is kept in front of the other while doing so is noted.

7. Screwing the cap of a bottle. The hand preferred to (a) pick up the bottle and (b) to open the screwcap of the bottle are noted.

8. Manual Preference.

a. A small ball is kept on the table. The hand preferred to pick up and throw the ball is noted.

b. Hand preferred to pick up a comb and to comb the hair is noted.

c. The hand preferred to pick up a spoon to simulate eating is noted.

d. Hand preferred for writing with a pen is noted.

9. Coramina's Test. The subject is instructed to draw a circle and a straight line, each in a single stroke, with either hand. The better of the two performances is noted.

10. Dropping pebbles in a bottle. An empty bottle with narrow opening and a set of eight pebbles in a cup are kept at a fixed distance from each other. Subject picks up the pebbles one at a time

and drops them in the bottle. The hand preferred and the time taken to complete the task with either hand are noted.

II. Passing a needle through dots. The test material consists of a panel of 25 fine circles each of one mm. diameter on a paper. The subject has to carefully prick through each of the circle with either hand using a pin. The hand preferred and the time taken to complete the task with either hand are noted.

B. LEG PREFERENCE.

I. Subject is instructed to sit on a chair with legs crossed and the leg coming above the other is noted.

2. Subject stands with both feet together and steps on to the stairs. The foot advanced first, to do so is noted.

3. Subject stands steady on one foot and draws the big toe of the other foot over a circle drawn on the ground. The foot preferred and the accuracy of the circle drawn with either foot are noted.

4. The foot preferred while hopping on a single foot is noted.

5. The foot preferred to kick a ball kept in front of the subject is noted.

6. The subject taps in a series on the floor with the forefoot of either lower limb. The dexterity of tapping with either of the foot is noted.

C.EYE PREFERENCE

I. The eye preferred to look through a pinhole, kept at eye level is noted.

2. The eye preferred to look through a paper tube is noted.

3. The eye preferred to look in to an empty bottle is noted.

D. EAR PREFERENCE

I. Subject stands six meters away from the examiner facing the opposite direction. The side to which he turns to face the examiner when his name is called is noted.

2. The ear which the subject prefers to listen to the ticking of a watch kept equidistant from both ears is noted.

Finally the results of all the tests are classified in to three categories.

I. Tests involving coarse movements.

II. Tests involving precision movements.

III. Tests involving time bound precision movements.

I A. Tests involving coarse movements

A. Upper Limb.

I. Hand preferred for taking cards.

2. Hand preferred for shuffling cards.

3. Dexterity of shuffling.

4. Dexterity of dealing cards.

5. Clapping - Hand kept above the other.

6. Folding arms across chest - Hand kept in front.
7. Hand preferred to pick up a bottle.
8. Hand preferred to open the bottle.
9. Hand preferred to throw a ball.
10. Hand preferred to comb hair.
11. Hand preferred to use a spoon.
12. Hand preferred to write.

I B. LOWER LIMB.

1. Leg kept above while sitting cross legged.
2. Leg advanced in climbing.
3. Foot preferred in hopping.
4. Foot preferred in kicking a ball.

II. TESTS FOR PRECISION MOVEMENTS

II A. UPPER LIMB.

1. Hand preferred in cutting a circle.
2. Dexterity of cutting a circle.
3. Hand preferred for beading.
4. Coramina's Tests.
5. Putting pebbles in a bottle.
6. Passing needle through dots.

II B. LOWER LIMB.

1. Foot preferred for drawing a circle.
2. Dexterity of drawing a circle.
3. Dexterity of tapping on floor.

III. TIME BOUND PRECISION MOVEMENTS.

I. Time taken to cut a circle out of paper.

2. Time taken to thread beads on a rod.

3. Time taken to put pebbles in a bottle.

4. Time taken to pass needle through dots.

C. TESTS FOR EYE PREFERENCE.

D. TESTS FOR EAR PREFERENCE.

****

RESULTS

The response of each subject to the full battery of tests is given in Table III to VI. In the case of folding the arms in front of the chest, 30% (6 Subjects) kept the right hand in front of the left and 70% (14 Subjects) did it in the reverse way. Apart from this single test all other tests were preferentially done by the right hand by majority of persons. This could be interpreted that the right hand moves first and is arranged across the chest and the left hand simply completes the activity, in which case again the manual preference shifts to the right side regarding that test.

There was no person who did all the tests with either right hand or left hand. Similarly there was no absolute concordance in the use of hand, leg, eye and ear. For example subject no. 10 who used left hand for almost all tests for upper limb but used the right leg, and right eye for doing the tests for lower limbs and eyes. There was only one subject who performed more then 50% of the tests with the left hand. Table VI summarises the frequencies with which either side was deployed in performing the different categories of tests. This clearly shows that lateralisation is manifested best in case of hands then legs followed by eyes and lastly ear. In the case of hands the lateralisation was clearly more evident for precision movements. But in the case of legs the reverse was observed. In fact this drift away from dextrality is due to

TABLE III

Test.

Patient No.

Total	Left Hand preference 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	HAND PREFERENCE – COARSE MOVEMENTS	Right Hand preference 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	Total
2	+ +	Hand - Taking cards	+ + + + + + + + + + + + + + + + + +	I8
I	+	Hand - Shuffling cards	+ + + + + + + + + + + + + + + + + +	I9
I	= + =	Dexterity of shuffling	+ + + + + + = + + + + + + + + + + =	I7
2	+ +	Dexterity of dealing cards	+ + + + + + + + + + + + + + + + + +	I8
3	+ + +	Clapping - Hand kept above	+ + + + + + + + + + + + + + + + + +	I7
I4	+ + + + + + + + + + + + + + + +	Folding armskept in front	+ + + + + *	6
II	+ + + + + + + + + + + + + + + +	Hand - To pick a bottle	+ + + + + + + + + + + + + + + + +	9
2	+ +	Hand - To open a bottle	+ + + + + + + + + + + + + + + + + +	I8
I	+	Throwing a ball	+ + + + + + + + + + + + + + + + + +	I9
I	+	Hand - To comb hair	+ + + + + + + + + + + + + + + + + +	I9
0		Handd- To use spoon	+ + + + + + + + + + + + + + + + + +	20
0		Hand - To write	+ + + + + + Q + + + + + + + + + + +	I9
		HAND PREFERED - PRECISION MOVE:		
0		Hand - Cutting a circle	+ + + + + + + + + + + + + + + + + +	20
I	= +	Dexterity of cutting	+ + + + + + + + + = + + + 0 + 0 + +	I6
I	+	Hand - For beading	+ + + + + + + + + + + + + + + + + +	I9
3	+ +	Coramina' Test	+ + + + + + + + + + + + + + + + + +	I7
I	+	Hand - Putting pebbles	+ + + + + + + + + + + + + + + + + +	I9
0		Hand - Passing needle	+ + + + + + + + + + + + + + + + + +	20
		HAND TIME-BOUND PRECISION MOVE:		
0		Cutting circle-Less time taken	+ + + + + + + + + + + + + + + + 0 + +	I9
I0	+ + + + + + + +	Beading thread-Less time taken	+ + + + + + + + + + + + + + + + + +	I0
8	+ + = + + + = + +	Putting pebbles inbottle ,,	+ + + + = + + + + = + + + + + + +	I0
2	+ +	Passing needle thro' dots ,,	+ + + + + + + + + + + + + + + + + +	I7
		LEG PREFERENCE & COARSE MEVEMENTS		
5	+ + + + +	Leg kept above while sitting	+ + + + + + + + + + + + + + + + + +	I5
7	+ + + + + + +	Leg advanced in climbing	+ + + + + + + + + + + + + + + + +	I3
9	+ + + + + + + + +	Foot prefered in hopping	+ + + + + = + + + + + + + + + +	I0
0		Foot prefered in kicking	+ + + + + + + + + + + + + + + + + +	20
		LEG - PRECISION MOVEMENTS		
2	+ +	Foot prefered in drawing	+ + + + + + + + + + + + + + + + + +	I8
I	= = + = = =	Dexterity of drawingcircle	+ + + + = + * * = * * + = + = + = + +	I4
2	= = = = = = + = = = = +	Dexterity of tapping floor	= + = = = + = = + * * + + = + = = +	9
		EYE PREFERENCE		
7	+ + + + + + + +	Eye - To look thro' pinhole	+ * + + + + + + + + + + + + + +	I3
		EAR PREFERENCE		
I4	+ + + + + + + + + + + + + +	Ear - To listen ticking	+ + + + + + + + + +	6

= Ambidextrous response

0 - Not tested.

HAND MOVEMENTS

Subject	Coarse Move: (12 Tests)			Precision Move: (6 Tests)			Precision - Time (4 Tests)		
	Rt.	Lt.	R/L	Rt.	Lt.	R/L	Rt.	Lt.	R/L
1.	11	1		6			4		
2.	11	1		6			4		
3.	10	2		6			4		
4.	12			6			2	2	
5.	12			6			2	2	
6.	10	2		6			4		
7.	7/11	3/11	1	6			3		1
8.	10	2		6			1	3	
9.	10	2		5	1		4		
10.	4	8		3	2	1	2	2	
11.	12			6			2	2	
12.	10	2		6			4		
13.	10	2		6			4		
14.	10	2		6			3	1	
15.	11	1		5/5			2	2	1
16.	11.	1		6			3	1	
17.	9	3		5	1		1	2	1
18.	10	2		4/5	1		3/3		
19.	10	2		5	1		2	2	
20.	9	2	1	6			2	2	
Percentage of Total	83%	16%	1%	94%	5%	1%	71%	25%	4%

the ambidextrous response (23%) for precision movements. There were no time bound precision movements for lower limbs which could have given a more objective answer. Tests for eyes and ears showed 65% and 55% dextrality respectively. A total of four tests could not be completed in three subjects due to technical reasons.

DISCUSSION.

Out of the 20 subjects studied only one person (5%) preferred right hand for less than 50% of the tests for coarse movements. He used right hand for 50% of the tests for precision movements and tests for time bound precision movements. According to Bloede [6] approximately 2 to 6% of general population is left handed. Russel Brain thinks that 5 - I0% of Anglo-Saxon population are left handed. It is generally considered that about I0% of General Population is left handed.

Another observation in this study is that in general, each person preferred right hand over left hand for precision movements. ie. In a battery of I2 tests for Coarse movements done by 20 subjects 83.17% tests were done by right hand and I5.96% were done by left hand. These 20 Subjects used right hand to perform 93.99% of the six test battery for precision movements, as against left hand for 5.17% of the tests. (Table VI). This phenomenon of recruiting right hand more frequently for precise movements were observed by other workers also [6].

It is also observed that the dexterity of movements and skill of right hand was less pronounced in time bound precision movements.

In a set of 4 tests of precision movements with time factor involved, 7I.25% of the study population were faster and more skilled with right hand. This is lower than the proportion for precision movements without time factor. No similar observation was made by any other worker. In this study the first response was taken as the hand preference. Some degree of learning the technique of performing the test is achieved during the first attempt with the preferred hand. When the same test is repeated by the nonpreferred hand the effect of learning could have manifested as faster response.

Right sidedness was manifest maximum for :

I.	Handedness	83%
2.	Leggedness	72%
3.	Eyedness	65%
4.	Earedness	55%

Hildreth [6] noticed that dominance of the left eye is more frequent than dominance of the left hand; the percentage varying from 62-73% for dominance of right eye and 2I-30% for left eye. According to Bärt the eye-hand correspondence has a tendency to decrease with age [6]. M.P. Bryden et. al. describe that the right ear is dominant for listening as shown by dichotic listening [9].

An aim of this project was to identify a few bedside tests to ascertain the cerebral dominance of any individual.

There was no consistent response by any individual to these tests. In general there was no difference in the hand preference for performing innate functions and learnt activities.

	Clapping (Innate	Throwing functions)	Combing (Learned	Writing activities)
Rt. Handers	85%	95%	95%	I00%
Lt. Handers	I5%	5%	5%	0%

Amongst the tests for hand coarse movements using a spoon and writing are selected as simple tests for which if a person chooses the left hand, he has a strong left handedness. Cutting a circle out of a paper and passing needle through dots are good tests to assess the manual preference for precision, for both these tests all test subjects chose right hand in this study. Kicking a ball can be of use as a good test for pedal dominance. Eye preferred to look through a pinhole and ear preferred to listen to the ticking of a watch can be used at bedside for ascertaining preference of these two organs.

CONCLUSION

A series of tests were administered to 20 subjects to ascertain the preference of the hand, leg, eye, and ear in performing coarse movements, precision movements and the responses were recorded in terms of manual preference and skill. The results showed that there was no I00% consistency in the responses and each subject prefers to perform some functions with right side and some others with left side. But over all there was a tendency to use right side more often than the left side which was maximum for hand, then leg, eye, and minimum for ear. Asymmetric functioning is best observed for precision movements than coarse movements. There was no distinction between innate functions and learnt functions as far as cerebral dominance is concerned.

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CEREBRAL DOMINENCE ASSESSMENT IN LEVOCARDIAC PERSONS

Name: Age

Address Sex M / F

I. Card shuffling & dealing

a. Hand prefered for taking the cards

b. Hand prefered for shuffling the cards

c. Dexterity of shuffling the cards

d. Hand prefered for dealing the cards

e. Dexterity of dealing the cards

2. Cutting a circle out of paper.

a. Hand prefered for cutting

B. Dexterity for cutting

c. Time taken for cutting (Seconds) R L

3. Winding a thread on a reel

a. Hand prefered for picking the thread

b. Hand prefered for winding the thread

4. Threading beads on a rod

a. Hand preference for picking & threading

b. Time taken to complete the task(Seconds) R L

5. Clapping

Hand which is kept above the other

6. Folding arms across the chest.

The arm which comes in front

7. Screwing the cap of a bottle

a. Hand prefered to pick the bottle

b. Hand prefered to open the bottle

8. Manual preference

a. Hand prefered for throwing a ball.

b. Hand prefered for combing hair

c. Hand prefered for using a spoon

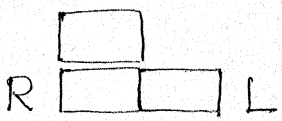
d. Hand prefered for writing

9. Coramina's test.

10. Dropping pebbles in a bottle

    a. Hand preference to put pebbles

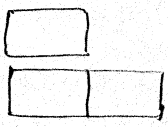
    b. Time taken to complete the task (Sec)



11. Passing a needle through dots

    a. Hand prefered to do the task

    b. Time taken to complete the task(Sec)

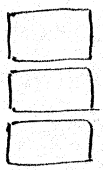


LEG PREFERENCE

1. Leg comming above while sitting
2. Leg advanced first in climbing stairs
3. Circle drawing with foot
    a. foot prefered
    b. accuracy of circle better with
4. Foot prefered for hopping
5. Foot prefered for kicking
6. Dexterity of tapping on floor with one foot

EYE PREFERENCE

1. Looking through a pinhole
2. Looking through a tube
3. Looking into a bottle



EAR PREFERENCE

1. Side to which one turns to listen to sound
2. Listening to the ticking of a watch