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Original Article

A preliminary study of Locognosia in people affected by leprosy

Mannam Ebenezer[1], Kelly Nail[2], Nanci Pradeepa[3]

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Locognosia is the ability to localize a sensory stimulus on the body's surface and can be tested by graded filaments (Semmes-Weinstein monofilaments). This point localization of sensation (locognosia) was tested by SW filaments over four quadrants of the pulp of the fingers in ulnar/median and ulnar paralysis in 38 new patients affected by leprosy. The results were compared with standard testing of sensation at selected sites by Semmes Weinstein monofilament. Both pulp quadrant testing and standard site testing were done in leprosy patients and also in a group of controls. Sensation was tested in 73 hands in leprosy patients and 34 hands in controls. Results indicate a positive correlation between locognosia and standard SW filament testing. When locognosia and standard SW filament tests were compared, there was significant difference between the two tests to pick up abnormal sensation in leprosy patients both over the entire hand and over individual fingers. This preliminary study suggests that locognosia may be a useful tool to diagnose sensory impairment in leprosy. Further studies are required to corroborate this.

Introduction

Leprosy is a chronic infectious disease affecting the skin and nerves. Nerve damage results in motor, sensory and autonomic impairment. Assessment of the nerve function is usually done by voluntary muscle testing and sensory testing. Currently, there are two main testing methods to assess the nerve function. These methods are sensory testing and voluntary muscle testing (VMT).

Sensory testing is carried out both by ball point pen and Semmes Weinstein monofilaments (Bell-Krotoski and Tomancik 1987, Lienhardt et al 1993, Anderson and Croft 1999). Other sensory tests include the two-point discrimination test, the pinprick test, the position sense test, and the vibration sense test (Jerosh-Herold 2000).

In a multi centric research project in India, nerve conduction, temperature, vibration, dynamometry, monofilaments and voluntary motor test were compared. The study reported good concordance between monofilaments and other sensory tests (van Brakel et al 2008).

Locognosia, the ability to localize touch, is one aspect of tactile spatial discrimination like other modalities of sensation depends upon the

[1] Head Branch of Surgery
[3] Physiotherapist
Schieffelin Institute of Health-Research and Leprosy Centre, Karigiri-632 106, Vellore, India
[2] Biology student, St Olaf College, USA
Correspondence to : Mannam Ebenezer **Email :** mannam_ebenezer@yahoo.co.in

integrity of peripheral nerve end organs, nerve continuity and the somatosensory representation of the surface of the body in the brain.

Recently, a standardized locognosia test was developed and tested on the hands of patients with nerve injuries (Jerosh-Herold 2006). Jerosch-Herold also felt that two point discrimination is too difficult to obtain a measurable threshold value and locognosia scored better in assessing patients with recovery after median nerve injuries (Jerosh-Herold 2000). He also reported on the test retest reliability and discriminant validity of locognosia in peripheral nerve injuries (Jerosh-Herold et al 2006). Mavrogenis also reported that locognosia picked up improvement in sensation better than static or moving two point discrimination (Marvogenis 2009).

Locognosia is tested on the pulp of the digits. For sensory testing the pulps of index and middle digits are autonomous zones for median nerve (solely supplied by median nerve) and the pulp of little finger is the autonomous zone for ulnar nerve (Jobe et al 1998).

The working hypotheses was that locognosia test will detect sensory impairment earlier than SW test in patients affected by leprosy who have sensory impairment.

Study population and Methodology

Inclusion and Exclusion criteria

Study participants were taken from a group of new untreated leprosy patients attending the out-patient department of the SLR&TC, Karigiri. Patients were excluded if they had any co-morbid conditions, which could also affect sensation, such as diabetes or alcoholism. In order to include as many patients as possible, no age exclusion criterion was set for this study.

In locognosia test each digit pulp was divided into four equal quadrants and sensation was tested in each quadrant. So locognosia is scored over 20 test sites in five digits. Each test site scores a maximum of 2 points. Each site is tested twice giving the hand a total score of 80. Every time a patient correctly identifies a quadrant, two points are received. If a patient identifies an incorrect quadrant on the correct finger, a score of one point is given. If a patient can identify the correct orientation of the quadrant, but on an adjacent finger, a score of one is given. If a patient can not feel the monofilament at all, a score of zero is given (Jerosch-Herold, 2006).

Since it is a preliminary study intra rater and inter rater reliability for testing locognosia on four quadrants of a finger pulp have not been done.

In the standard sensory test, palmar surface over the distal phalanx is tested for all four fingers and thumb. Each site is scored 5 if 200 mg filament is felt and 0 if all the five filaments are not felt. The site is scored 4 if 2 gm filament is felt, 3 if 4 gm filament is felt, 2 if 10 gm filament is felt and 1 if 300 gm filament is felt. So the maximum score for a finger would be 5 and for total score for all the digits would be 25.

Data Collection

The test was first explained to the patient in Tamil by a physiotherapy intern or a physiotherapist. The modified version of the test used (Jerosch-Herold 2006) was explained to the patient.

The patient was first instructed to place their hand flat on the table in the testing box. This enabled the subject to keep their eyes open to look at the labeled diagram of their hand, while at the same time not being able to see their test hand. A hand diagram was shown to the patient where the distal pulp of each digit (the digit tip) was divided into four quadrants, numbered 1-20 (Appendix). Patient is asked to identify, which quadrant was being touched on their own digits with a monofilament. The study began after the patient had successively identified correctly two quadrants that had been touched by the largest diameter monofilament.

The results for both the Semmes-Weinstein monofilament test and the locognosia test were

then sorted into categories by finger, nerve, and total score for the fingertips of each hand. Locognosia test results were compared to the corresponding SWMT results. Data was entered into Excel and analyzed using both Excel and Stata 9 computer software. McNemar's test for concordance is used.

Results

A total of 38 active leprosy patients were included in this study (26 males and 12 females). Patients were included even if only one hand was usable for the study, leaving a total of 37 right hands and 36 left hands (73 total hands). The most common line of work was manual labor, with 17 people reported their job was "coolie," worker, or farmer. The next most common response was housewife, with 14 patients giving this response. Most of the other reported occupations were skill based.

The mean age of the patients was 41.1 (standard deviation 15.6, range 17-73, median 43.5).

When SW filament test and locognosia test are compared for the entire hand, 30 hands which tested normal with SW filament test (a score of 20 or more), had abnormal locognosia (below a score of 57, 57 being the lowest score for the hand). This is statistically significant ($p<.0.001$). (Table 1)

When the four patients who showed sensory impairment with SW filament test who showed normal locognosia test were examined it was noted that both the SW filament scores and locognosia scores for these patients are close to the normal cut off values used in the study.

When Standard sensory test and locognosia test are compared for fingers, out of the 265 fingers, 58 fingers which had normal sensation, as tested by SW filaments (a score of 4 or above) had abnormal locognosia (a score less than 8, 8 being the lowest score for a finger). This difference is statistically significant ($p< 0.001$). (Table 2)

When looking at leprosy patients separately, the generalized linear model suggested a significant positive correlation between total locognosia scores and the Semmes-Weinstein monofilament test scores (p-value < 0.001).

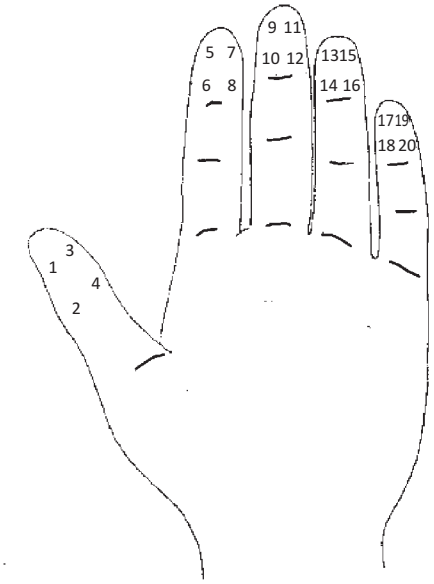
There also appears to be a significant negative correlation between locognosia test scores and age when looking at patients alone (p-values 0.003 and 0.048, respectively). Using the generalized linear model, there does not appear a significant correlation between locognosia scores for the left and right hands (p-value 0.408).

Table 1 : Comparison of Standard SW Test and Locognosia test in patients (n=73 hands)

Sensory Test		SW Filament Test	
		Normal	Abnormal
Locognosia	Normal	30	4
Locognosia	Abnormal	30	9

Table 2 : Comparison of SW Filaments and Locognosia tests - fingers (n=365)

Sensory Test		SW Filament Test	
		Normal	Abnormal
Locognosia test	Normal	285	9
Locognosia test	Abnormal	58	13



Appendix - Smaller Version of the hand chart used for patients

Discussion

In analyzing the scores for locognosia test and standard SW filament test for the entire hand and for individual fingers, there is statistically significant difference between standard SW filament test and locognosia in detecting nerve function impairment.

The fact that locognosia is negatively correlated with age may be due to several factors. In observing the patients, many of the older patients had more callused hands, which may have affected their ability to localize touch. This negative correlation might also be related to a cognitive decline, which may either affect a patient's locognosia or their ability to understand the test directions.

Locognosia test takes about 15 – 20 minutes to complete and has not been difficult to administer. Even patients with minimal literacy were able to go through the test once the test is fully explained.

The need of the hour in leprosy neuropathy is a test which can detect nerve function impairment early so that early treatment may reverse the impairment and prevent disability.

A longitudinal study in future will be beneficial if this can establish as a test to diagnose nerve function impairment early in leprosy. This would also help in monitoring nerve function recovery. It might be helpful to design a shortened version and test the validity and reliability of such a test.

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