ORIGINAL RESEARCH PAPER
Volume-6 | Issue-12 | December-2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 93.98
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

HIGH RESOLUTION SONOGRAPHY TO DETECT NERVE DAMAGE IN LEPROSY- A CASE CONTROL STUDY

Dermatology

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ABSTRACT

Background and objectives: Leprosy is an infectious chronic granulomatous disease which primarily affects the skin and nerves. It can lead to severe nerve damage and furthermore deformities if not detected in time. In this study we have used high resolution USG and Colour Doppler to diagnose nerve damage and nerve changes in leprosy and lepra reactions .

AIMS AND OBJECTIVES: To evaluate the role of high resolution ultrasonography to assess peripheral nerve damage in leprosy and to compare the nerve involvement in leprosy patients with healthy controls.

METHODOLOGY: Twenty cases of leprosy were taken and bilateral USG and CD of ulnar, median, lateral popliteal, posterior tibial nerves was performed. Twenty age and sex matched controls were taken and USG findings of both cases and controls were compared.

RESULTS: Mean CSA of ulnar nerve was 19.66mm2, median nerve 15.15mm2 , lateral popliteal 15.84mm2 and of posterior tibial 15.35mm2 respectively in cases and 7.94mm2,5.4mm2,7.8mm2 ,8.6mm2 respectively in controls.Out of 20 cases, increased vascularity on CD was seen in 9(45%) patients . Moderate echoreflectivity was seen in six(30%) cases.

CONCLUSION: USG is a cost effective, rapid, imaging technique as to detect early damage and extent of nerve damage in the leprosy. Clinical examination of the nerves is a very subjective method where as USG provides us an objective measure. Hence it should be included as a routine procedure to supplement clinical diagnosis of leprosy. Early diagnosis of nerve damage will help in prevention of disability and its complications.

KEYWORDS

Ultrasonography , Colour Doppler.

INTRODUCTION

Leprosy also known as Hansen's disease, is an infectious chronic granulomatous disease caused by Mycobacterium leprae which mainly affects the skin and peripheral nerves.[1]Mycobacterium leprae was discovered by G.H Armauer Hansen in 1873. It is the only bacterium which affects myelination and causes peripheral neuropathy[2].

Human beings are the main source of infection but armadillo is incriminated as reservoir in some part of the world.[3] Leprosy is transmitted through droplet infection during close contact with those who are infected. It has a long incubation period of 5-7 yrs.[3] Various favourable factors are low education, poor hygiene, malnutrition, overcrowding, low socio-economic status.

According to WHO, global registered prevalence of leprosy was 176 176 cases at the end of 2015. During the same year, 211 973 new cases were reported. Although leprosy is eliminated from India statistically but the disease still poses challenges, as new cases have been reported consistently and pockets of endemicity continue to persist.

MATERIAL AND METHOD

The study was conducted on 40 patients (20 cases of leprosy and 20 controls) attending dermatology OPD at Maharishi Markandeshwar Institute of Medical sciences and Research (MMIMSR) Mullana,Ambala India after assessing their eligibility according to the selection criteria.

The diagnosis of leprosy was based on clinical signs and symptoms, skin smears and skin biopsy. After the diagnosis of leprosy subjects were evaluated for nerve thickening by ultrasonography.

The participation was totally voluntary and an informed consent was taken from all the cases and controls. Clinical cases of leprosy were biopsied and confirmed histopathologically. A detailed medical history along with physical examination had been undertaken after statisfying the inclusion criteria, predesigned and prestructure Proforma was filled. According to the diagnosis the disease was classified as per Ridley Jopling Classification.[4]

All the cases and controls were examined for bilateral ulnar nerve, median nerve, lateral popliteal nerve and posterior tibial nerve. Motor and sensory testing of the nerves function were also done.

Ulnar nerve (UN): Individual case and control were examined for present symptoms of damage in the nerve, i.e. numbness and paraesthesia in the fourth and fifth digits of the hand, elbow pain medially, wasting of the hand muscles supplied by the ulnar nerve.

Testing of both the arms was done by
(1) pin-prick sensation using SW monofilaments
(2) By using Medical Research Council (MRC) rating scale strength of the first dorsal interosseous (FDI) and abductor digiti minimi (ADM) was checked.

Median nerve (MN): Pin-prick sensation was done in the areas of distribution by using monofilaments and motor function of abductor pollicis brevis checked. (APB).

Lateral Popliteal (LP): testing of the power of the extensor halluces longus and anterior tibial was done.

Posterior tibial (PT): pin-prick sensation was performed at the foot on heel and sole using monofilaments and symptoms of damage in the posterior tibial nerve was noted. The muscle power of the toe and foot flexors was also noted.

SONOGRAPHY

Four peripheral nerves were taken into consideration i.e ulnar nerve, median nerve, lateral popliteal and posterior tibial.

In the suspected cases bilateral examination by HRUS of the ulnar, median, lateral popliteal, posterior tibial was performed. Nerves were examined along the whole length and the abnormality was detected by the presence of abnormal size and echodensity of the nerves.

All the nerves were measured on transverse sections, the area where there was maximum thickness was visualized and was noted. The cross sectional area of the nerve has been taken by the area within the inner

margin of the hyperechoic rim. Vascularity was assessed by placing a power Doppler box over the nerve and slowly increasing the gain. Colour flow in the nerves indicates hypervascularity.

Echogenicity of the nerve was assessed on subjective basis however it can introduce error and can be biased. Increased intraneural edema may result in reduced echogenecity and loss of fasicular pattern indicative of inflammatory pathology

All sonographic examinations were perfomed on ultrasound machine; Epiq 7G (Philips medical systems U.S.A) using a multi frequency of 5-18 MHz probe. All examinations were performed by a specialized radiologist.

DATA ANALYSIS: After all the data was collected, it was tabulated and analysed using appropriate statistical methods i.e t test using software SPSS (statistical package for social sciences) version 20. P value < 0.05 will be considered significant at 95% confidence internal.

RESULTS

In the present study, the youngest participant was aged 11 years and the oldest was 80 years old.

Out of 20 cases , 11 were males (55%) and 9 (45%) were females showing slight male preponderance.

On histopathological examination it was found that most of the patients had either BT or LL 9 (45%) each .Only 1(5%) patient each had TT and BL.

Out of 20 leprosy cases, 15 had clinically palpable nerves. Eight (40%) patients had grade1 thickening 5(25%) patients had grade 2 thickening and 2(10%) patients had grade 3 thickening respectively.

Six(30%) patients had grade 1 thickening among controls.

Nerve thickening	Group A		Group B	
	Number	Percentage	Number	Percentage
Grade 0	5	25	14	70
Grade 1	8	40	6	30
Grade 2	5	25	0	0
Grade 3	2	10	0	0
Total	20	100	20	100

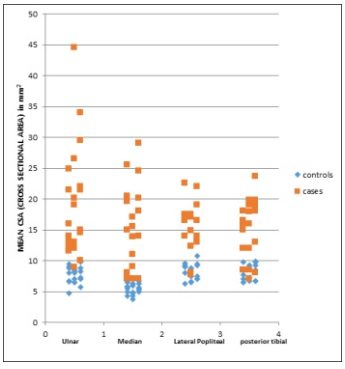
		Ulnar	Median	Lateral	Posterior tibial nerve
Group A Leprosy Patients	Mean	19.66±9.73	15.15± 7.07	15.84±4.37	15.35±4.96
	Median	16.65	14	16	16
Group B Controls	Mean	7.94±1.35	5.37±1.09	7.81±1.39	8.26±1.28
	Median	8.0	5.5	7.75	8
P value		<0.001	<0.001	<0.001	<0.001

Combined mean of CSA of ulnar nerve was 19.66+/-9.73 mm^2 for leprosy patients and 7.94+/-1.35 mm^2 for control group.

Combined mean of CSA of median nerve was 15.15+/-7.07mm^2 for leprosy patients and 5.37+/-1.09 mm^2 for control group.

Combined mean of CSA of lateral popliteal nerve was 7.81+/-1.39mm^2 for leprosy patients and 7.81+/-1.39 mm^2 for control group.

Combined mean of CSA of posterior tibial nerve was 15.35+/-4.96 mm^2 for leprosy patients and 8.26+/-1.28 mm^2 for control group.



Out of the 20 cases, ultrasonography of the nerves in 11 patients (55%) showed no vascularity while 3(15%) patient had epineural flow and 3(15%) patients had perineural flow and only 1(5%) patient had endoneural flow in ulnar nerve. In 1 patient, flow was present in the perineurium of both ulnar and lateral popliteal nerve. Out of 12 cases of clinically diagnosed type 1 / type 2 reaction only 9 cases showed increased vascularity on colour Doppler .

Vascularity	Group A		Group B	
	Number	Percentage	Number	Percentage
Nil	11	55.0	20	100.0
endoneural(ul)	1	5.0	0	0.0
epineural(ul)	3	15.0	0	0.0
perineural(ul)	3	15.0	0	0.0
en and pn (ul)	1	5.0	0	0.0
perineural(ul,lp)	1	5.0	0	0.0
Total	20	100.0	20	100.0

Out of the 20 cases, 45% of the patients had normal echoreflectivity and 6(30%) patients had moderately reduced echoreflectivity while only 1(5%) patient had severely reduced echoreflectivity.

Reflectivity	No of patients	Percentage
Normal	9	45%
Mild reduced	4	20%
Moderate reduced	6	30%
Severe reduced	1	5%
Total	20	100%

DISSCUSSION

Leprosy is an infectious, chronic granulomatous disease which primarily affects the skin and nerves. It is one of the oldest diseases known to mankind and has been associated with considerable stigma.

The commonly used methods for nerve testing are sensation testing and nerve conduction studies. However a definite diagnosis of nerve involvement is dependent on nerve biopsy findings.[5] Nerve biopsy, on the other hand is an invasive procedure, and can cause further loss of sensation, adding to the deformity. Clinical palpation of the nerves in leprosy is a very subjective and inaccurate method and there occurs considerable inter- observer variation.[6] High resolution sonography is a non invasive imaging technique which provides real time examination of deeper tissues including the peripheral nerves in static well as in dynamic (blood flow) state[7] High resolution ultrasonography and colour Doppler can be used to demonstrate nerve enlargement and inflammation very efficiently.

Out of 20 leprosy cases, 15 (75%)had clinically palpable nerves.However on USG 18(90%) cases had thickened nerves.This highlights the fact that USG can easily identify the involved nerves which are missed on clinical palpation.

In our study the mean cross sectional area (CSA) of the ulnar, median, lateral popliteal and posterior tibial nerves in leprosy patients was similar to that reported by other authors like Suman *et al*[2], Bathala *et al*[8] and Lugao HB *et al*[9].The broad concurrence in nerve size implies that assessment of nerve size by USG is devoid of subjective inter-observer variations. Moreover the exact values given by USG are easily reproducible which doesn't hold true for clinical assessment of nerves even by experienced physicians.

Assessment of vascularity can become a very important means for diagnosing lepra reactions.In our study 9 (75%) out of 12 patients with clinically diagnosed Type 1/2 lepra reaction showed increased neural vascularity on colour Doppler. However none of the leprosy patients without lepra reaction showed increased vascularity. Similarly Suman *et al*[2] reported in their study that all the nerves with neural vascularity were from the patients who had associated leprosy reactions.However S*wati et al*[10] reported that 37.5% of the nerves in patients with reaction showed increased vascularity and 12.5% of nerves in patients without reaction also showed increased vascularity which was not the case in our study . Further studies with more number of cases are required to establish role of colour Doppler in lepra reactions.

In the present study we found that 9 patients (45%) showed normal echoreflectivity . This was comparable to the results shown by Suman *et al*[2] in which 50% of the patients showed normal echoreflectivity. Seventy six percent of the patients had shown normal echoreflectivity

in a study done by Disha Kriplani *et al*[6] consisting of all mild, moderate and severe changes. In our study 55% of patients had altered echoreflectivity.

In the present study we found that nerve thickening (90%) was the most common finding ultrasonographically, followed by the impaired echotexture (55%) and increased vascularity (45%).

The extent, destruction, surrounding structures of the nerves cannot be assessed accurately on clinical examination. Thus the clinical examination is very much subjective and inaccurate method. Ultrasonography provides an objective measure by showing the exact thickness ,distorted echotexture and surrounding structures. It was seen that more number of nerves were involved than expected. In the absence of visible skin lesion and acid fast bacilli in SSS, pure neuritic leprosy continues to be a diagnostic challenge.USG can be very effective in diagnosing these cases.

This study concludes that HRUS is a readily applicable imaging modality, capable of real time static and providing morphological information concerning the nerves and the tissues. It has been proved to be a precious complementary tool for assessing nerve lesions with respect to their exact location, continuity and course. Colour Doppler imaging can be performed to look for absence or presence of blood flow signals in the perineural and infrafasicular vessels of nerve trunk. Nerves of patients with leprosy reactions have shown increased vascularity in Colour Doppler in the perineurium and endoneurium indicative of increased vascularity. Moreover it can support clinical and electrophysiological testing for detection of variety of nerve abnormalities in leprosy.

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