(9)

ANNEXURE 3

SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES

PUDUCHERRY

TOPIC: otoacoustic emission **(ENT 07)**

STUDENT NAME: Divya -S

UNIVERSITY NO: U1CMB21 3 -

1. Screening test for neonates in icu:

a.Transient evoked OAE b.Distortion product OAE

c.Automated OAE d.ASSR

2. Otoacoustic emsion are done when following is damaged

a. Outer hair cells b. ressiener's membrane

c. inner hair cells d. otolithic membrane

3. True statement about OAE

a. spontaneous oae is absent in 50% normal individuals

b. absent in retro cochlear lesion

c. Absent in hearing loss less than 30 db

d. All of the above

4.OAE arise from

a.Inner hair cells b. Outer hair cell

c. Both inner and outer d. Macula

5. Initial screening test for new born hearing disorder

a. ABR b. OAE

c. Free field audiometer d. Visual reinforcement audiometer

6. In neonate the most sensitive audiometric screening is

a. Electrocochleagraphy b.OAE c.BERA d.Tymhanomtery

7. true about oto acoustic emission

a. are by product of inner hair cells

b. are by productofouter hair cells

c. used as a screening test of hearing in new born

d.useful in ototoxicity monitoring

8. If OAE are absent the result is mention as :

a. pass b. fail

c. absent d. refer

9. all of the features are of cochlear hearing loss except

a. SISI test is positive

b. Speech discrimination is highly impaired

c. OAE absent

d. Damage to the inner and outer hair cell

10. best time for hearing assessment in infants

a. during 1st month b. 3-6 month

c. 6-9 months d. 9-12 months

(7)

ANNEXURE 3

SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES

PUDUCHERRY

TOPIC: otoacoustic emission **(ENT 07)**

STUDENT NAME: Dhanush .R

UNIVERSITY NO: U15MB279. -

1. Screening test for neonates in icu:

a.Transient evoked OAE b.Distortion product OAE

c.Automated OAE d.ASSR

2. Otoacoustic emsion are done when following is damaged

a. Outer hair cells b. ressiener's membrane

c. inner hair cells d. otolithic membrane

3. True statement about OAE

a. spontaneous oae is absent in 50% normal individuals

X b. absent in retro cochlear lesion

c. Absent in hearing loss less than 30 db

d. All of the above

4.OAE arise from

a.Inner hair cells b. Outer hair cell

c. Both inner and outer d. Macula

5. Initial screening test for new born hearing disorder

X a. ABR b. OAE

c. Free field audiometer d. Visual reinforcement audiometer

ANNEXURE 4

Sri Lakshmi Narayana Institute of Medical Sciences

Affiliated to Bharath Institute of Higher Education & Research
(Deemed to be University under section 3 of the UGC Act 1956)

CERTIFICATE OF MERIT

This is to certify that _____ has actively participated in the Value Added Course on Hands on experience of Screening infants with OAE held during May 2018 – Aug 2018 Organized by Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry- 605 502, India.

Dr.K.R.Jothikumar
RESOURCE PERSON

Dr.R.Venkataramanan
COORDINATOR

Sri Lakshmi Narayana Institute of Medical Sciences

Affiliated to Bharath Institute of Higher Education & Research

(Deemed to be University under section 3 of the UGC Act 1956)

CERTIFICATE OF MERIT

This is to certify that Dr.Dhanapriya.P(U15MB277) has actively participated in the Value Added Course on Hands on experience of Screening infants with OAE held during May 2018 – Aug 2018 Organized by Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry- 605 502, India.

Dr.K.R.Jothikumar

RESOURCE PERSON

Dr.R.Venkataramanan

COORDINATOR

Annexure 5

Course/Training Feedback Form

Student Feedback Form

Course Name: Hands on experience of Screening infants with OAE

Subject Code: **ENT07**

Name of Student: _____ Roll No.: _____

We are constantly looking to improve our classes and deliver the best training to you. Your evaluations, comments and suggestions will help us to improve our performance

Sl. NO	Particulars	1	2	3	4	5
1	Objective of the course is clear					
2	Course contents met with your expectations					
3	Lecturer sequence was well planned					
4	Lectures were clear and easy to understand					
5	Teaching aids were effective					
6	Instructors encourage interaction and were helpful					
7	The level of the course					
8	Overall rating of the course	1	2	3	4	5

**** Rating: 5 – Outstanding; 4 - Excellent; 3 – Good; 2– Satisfactory; 1 - Not-Satisfactory***

Suggestions if any:

Annexure 5

Course/Training Feedback Form

Student Feedback Form

Course Name: Hands on experience of Screening infants with OAE

Subject Code: EN107

Name of Student: P. DIANA PEVA Roll No: 112308244

We are constantly looking to improve our classes and deliver the best training to you. Your evaluations, comments and suggestions will help us to improve our performance

Sl. NO	Particulars	1	2	3	4	5
1	Objective of the course is clear		✓			
2	Course contents met with your expectations	✓				
3	Lecturer sequence was well planned			✓		
4	Lectures were clear and easy to understand			✓		
5	Teaching aids were effective	✓				
6	Instructors encourage interaction and were helpful		✓			
7	The level of the course			✓		
8	Overall rating of the course	1	2	3	4	5

** Rating: 5 – Outstanding; 4 - Excellent; 3 – Good; 2- Satisfactory; 1 - Not Satisfactory*

Suggestions if any:

—

Annexure 5

Course/Training Feedback Form

Student Feedback Form

Course Name Hands on experience of Screening infants with OAE

Subject Code **ENT07**

Name of Student M DHANALAKSHMI Roll No. U15MB278

We are constantly looking to improve our classes and deliver the best training to you. Your evaluations, comments and suggestions will help us to improve our performance

SL NO	Particulars	1	2	3	4	5
1	Objective of the course is clear		✓			
2	Course contents met with your expectations			✓		
3	Lecturer sequence was well planned		✓			
4	Lectures were clear and easy to understand			✓		
5	Teaching aids were effective				✓	
6	Instructors encourage interaction and were helpful				✓	
7	The level of the course					✓
8	Overall rating of the course	1	2	3	4	5

** Rating: 5 – Outstanding; 4 - Excellent; 3 – Good; 2- Satisfactory; 1 - Not-Satisfactory*

Suggestions if any:

Overall, it was good

ANNEXURE 6

Date : 15/08/2018

From
Dr.K.R. Jothikumar,
Dept of Otorhinolaryngology,
SLIMS
Bharath Institute of Higher Education and Research,
Puducherry.

Through Proper Channel

To
The Dean,
SLIMS,
Bharath Institute of Higher Education and Research,
Puducherry.

Sub: Completion of value-added course: Hands on experience of Screening infants with OAE reg.

Dear Sir,

With reference to the subject mentioned above, the department has conducted thevalue-added course titled: **Hands on experience of Screening infants with OAE** on May 2018to Aug 2018. We solicit your kind action to send certificates for the participants, that is attached with this letter. Also, I am attaching the photographs captured during the conduct of the course.

Kind Regards
Dr.K.R.Jothikumar
<HOD Sign and Seal>

Sri Lakshmi Narayana Institute of Medical Sciences

Date:12.04.2018

N From
DR.Senthil kumar.
Professor and Head.
Department of Physiology,
SLIMS
Bharath Institute of Higher Education and Research.
Chennai.

To
The Dean,
SLIMS
Bharath Institute of Higher Education and Research.
Chennai

Sub: Permission to conduct value-added course: CERTIFICATE COURSE ON NERVE CONDUCTION STUDY AND ITS APPLICATION

Dear Sir,

With reference to the subject mentioned above, the department proposes to conduct a value-added course titled Certificate course on nerve conduction study and its application on December 2019. We solicit your kind permission for the same

Kind Regards

Dr Senthil kumar

FOR THE USE OF DEANS OFFICE

Names of Committee members for evaluating the course:

The Dean: Dr. Vijayalakshmi

The HOD: Dr. Senthilkumar

The Expert: Dr. B. Sivaranjagopal

The committee has discussed about the course and is approved.

Dean	Subject Expert	HOD
(Sign & Seal)	(Sign & Seal)	(Sign & Seal)

Circular

19.04.2018

Sub: Organising Value-added Course: reg CERTIFICATE COURSE ON NERVE CONDUCTION STUDY AND ITS APPLICATION

With reference to the above mentioned subject, it is to bring to your notice that Sri Lakshmi Narayana Institute of Medical Sciences, **Bharath Institute of Higher Education and Research.** is organising "**_certificate course on nerve conduction study and its application**

". The course content and registration form is enclosed below."

The application must reach the institution along with all the necessary documents as mentioned. The hard copy of the application should be sent to the institution by registered/ speed post only so as to reach on or before may . Applications received after the mentioned date shall not be entertained under any circumstances.

Dean

Course Proposal

Course Title: certificate course on nerve conduction study and its application

Course Objective: 1. To apply knowledge of Neuroanatomy with obtained nerve conduction test results

2. To differentiate nerve and muscle pathology

Course Outcome: Demonstrate knowledge of peripheral **nerve** and muscle anatomy and physiology.

Course Audience: Medical undergraduates

Course Coordinator: Dr.B.Deivanayagame

Course Faculties with Qualification and Designation:

1.Dr.Senthil kumar

2.Dr.B.Deivanayagame

Course Curriculum/Topics with schedule (Min of 30 hours)

S No	Date	Topic	Time	Hours
1	05.05.2018	Introduction		2hrs
2	11.06.2018	Medical uses		2hrs
3	14.062018	Interpretation of nerve conduction study		2hrs
4	16.06.2018	Factors affecting nerve conduction velocity		2hrs
5	18.06.2018	Physio clinical significance of nerve conduction study		2hrs
6	19.06.2018	Precautions		2hrs
7	20.06.2018	Motor nerve conduction		2hrs
8	22.06.2018	Sensory nerve conduction		2hrs
9	24.06.2018	Procedure and normal values		2hrs
10	26.06.2018	complications		
11	01.07.2018	Repetitive nerve stimulation		2hrs
12	03.07.2018	Protocol for evaluating nerve conduction study		2hrs
13.	04.07.2018	Artifacts and technical errors		2hrs
14.	06.07.2018	Cardinal rules of nerve conduction study		2hrs
15	08.07.2018	Summary and recommendations		2hrs
			Total Hours	30

REFERENCE BOOKS;

1. *Principles of clinical electromyography case studies*. Baltimore: Lippincott Williams & Wilkins, 1998

2. Brancic C, Cooper R, Maugnière F, *et al.Clinical neurophysiology 1 of 1 & 2*. **Elsevier 2004.** ▸ A reference text covering all aspects of clinical neurophysiology including nerve conduction studies. Primarily aimed towards those training in clinical neurophysiology.

VALUE ADDED COURSE

1. Name of the programme & Code

Certificate course on Nerve conduction study and its application

2. Duration & Period

30 hrs & may 2018- july2018

3. Information Brochure and Course Content of Value Added Courses

Enclosed as Annexure- I

4. List of students enrolled

Enclosed as Annexure- II

5. Assessment procedures:

Multiple choice questions- *Enclosed as Annexure- III*

6. Certificate model

Enclosed as Annexure- IV

7. No. of times offered during the same year.

30 hrs & May 2018 July2018

8. Year of discontinuation: 2018

9. Summary report of each program year-wise

Value Added Course –may 2018-july 2018

Sl. No	Course Code	Course Name	Resource Persons	Target Students	Strength & Year
1	PHYC07	Nerve conduction study and its application	Dr. B.Deivanayagame	1st MBBS	20 (May 18 - July 2018)

10. Course Feed Back

Enclosed as Annexure- V

RESOURCE PERSON

COORDINATOR

ANNEXURE 1

Nerve conduction study and its application

PARTICIPANT HAND BOOK

COURSE DETAILS

Particulars	Description
Course Title	Overview of Nerve conduction study and its application
Course Code	PHYC07
Objective	1.Introduction 2.Medical uses 3. Sensory nerve conduction 4. Motor nerve conduction 5. Repetitive nerve stimulation 6. Technique 7. Procedure and normal values 8. Precautions 9. Interpretation of nerve conductions 10. artifacts and technical errors 11. Protocol for evaluating nerve conduction study 12. factors affecting nerve conduction velocity 13.patient risk and complications 14.Cardinal rules of nerve conduction study 15.Summary and recommendations
Further learning opportunities	Other electrophysiological studies
Key Competencies	On successful completion of the course the students should acquire the skill to inderstand the appropriate clinical indication and interpret NCS in adult population
Target Student	1st MBBS Students
Duration	30hrs Every September 2018-december 2018
Theory Session	10hrs
Practical Session	20hrs
Assessment Procedure	Multiple choice questions

Introduction:

A **nerve conduction study** (NCS) is a medical diagnostic test commonly used to evaluate the function, especially the ability of electrical conduction, of the motor and sensory nerves of the human body. These tests may be performed by medical specialists such as clinical neurophysiologists, physical therapists, chiropractors, physiatrists (physical medicine and rehabilitation physicians), and neurologists who subspecialize in electrodiagnostic medicine. In the United States, neurologists and physiatrists receive training in electrodiagnostic medicine (performing needle electromyography (EMG) and NCSs as part of residency training and in some cases acquire additional expertise during a fellowship in clinical neurophysiology, electrodiagnostic medicine, or neuromuscular medicine.

Nerve conduction studies (NCS), together with the needle electrode examination (NEE), constitute the electrodiagnostic examination. For most neuromuscular diagnostic problems, the NCS are the initial probe into the peripheral nervous system. The findings from the NCS will dictate what muscles must be studied during the subsequent NEE. Usually a complete electrodiagnostic impression depends upon the findings of both the NCS and the NEE, but only the NCS can confirm the presence of entrapment mononeuropathies, demyelinating neuropathies, and defects of neuromuscular junction (NMJ) transmission. Responses can be recorded along peripheral motor and sensory axons. Characteristics of the responses include the amplitude, duration, latency, and velocity of responses. From these parameters, patterns of nerve pathology can be identified, including axon loss, demyelination, and conduction block. Although there are no specific NCS features of myopathy, muscle fiber loss and muscle fiber inexcitability affect the amplitude of motor responses. With NMJ transmission defects, specific abnormalities on NCS are identified.

Generation of an Action Potential An electrical stimulus applied to a sensory or motor nerve fiber opens voltage-gated sodium channels in the nerve fiber membrane, leading to sodium influx and local depolarization of the membrane. If the threshold of depolarization is reached, a self-sustaining electrical impulse is generated at that site, termed an "action potential". The action potential is

propagated along the nerve fiber by sequentially depolarizing the membrane in both directions from the original point of stimulation. The Sensory Nerve Action Potential (SNAP) The electrical field generated around a propagated action potential can be measured at some distance from the nerve fiber itself, but the size of the recorded response drops off as a square of the distance between the generator and the recording electrodes. When a group of nerve fiber action potentials are being propagated simultaneously in a nerve trunk, the electrical fields of the potentials summate in the surrounding area, known as the volume conductor. The SNAP is recorded from tin disc electrodes placed on the skin over the nerve trunk, either proximal or distal to the stimulation point of the nerve. It represents the summation of action potentials from all recordable nerve fibers in the volume conductor. Measurable features of a SNAP include the amplitude, duration, latency, and configuration (figure 1). SNAP amplitudes range from 5 to over 200 microvolts, depending on the particular nerve trunk being studied. Normally the SNAP is a triphasic waveform with an initial positive deflection, because the propagated depolarization along the nerve trunk approaches the recording electrode from the stimulation site. The Compound Muscle Action Potential (CMAP) With motor NCS, stimulation is applied at distal and proximal sites along a nerve trunk. Recording of the resulting action potential occurs with surface electrodes overlying a muscle belly innervated by the stimulated nerve. Since the active recording electrode overlies a muscle belly, the recorded response is a compound muscle action potential (CMAP), not a nerve action potential. The CMAP represents a summation in the volume conductor of all the individual muscle fiber action potentials activated by the stimulus and within the pick up territory of the active recording electrode. Normally, the CMAP is a biphasic waveform with an initial negative deflection (figure 2). This configuration results from placement of the active recording electrode at the motor point of the muscle belly, where the muscle fibers are initially depolarized and their action potentials are generated. Displacement of the active recording electrode off the motor point will result in an initial positive deflection in the recorded CMAP due to volume conduction of the muscle fiber action potentials from the motor point to the electrode. The CMAP is measured in millivolts, compared to microvolts for a sensory action potential, because the size of an action potential is proportional to the diameter of the excitable tissue from which it is derived

Medical uses : Nerve conduction studies along with needle electromyography measure nerve and muscle function, and may be indicated when there is pain in the limbs, weakness from spinal nerve compression, or concern about some other neurologic injury or disorder.[5] Spinal nerve injury does not cause neck, mid back pain or low back pain, and for this reason, evidence has not shown EMG or NCS to be helpful in diagnosing causes of axial lumbar pain, thoracic pain, or cervical spine pain.

Nerve conduction studies are used mainly for evaluation of paresthesias (numbness, tingling, burning) and/or weakness of the arms and legs. The type of study required is dependent in part by the symptoms presented. A physical exam and thorough history also help to direct the investigation. Some of the common disorders that can be diagnosed by nerve conduction studies are:

- Carpal tunnel syndrome
- Cubital Tunnel Syndrome
- Guillain–Barré syndrome
- Guyon's canal syndrome
- Peripheral neuropathy
- Peroneal neuropathy
- Spinal disc herniation
- Tarsal Tunnel Syndrome

Other conditions

- Radiculopathy
- Neuromuscular junction defects
- Myasthenia Gravis
- LEMS
- Motor Neuron Disease
- ALS
- Sensory Neuronopathy
- Sjogren's disease

SENSORY NERVE CONDUCTION Sensory nerve conduction studies are used to assess the functional integrity of sensory nerve fibers. They measure the amplitude and velocity of somatosensory-induced sensory nerve action potentials (SNAPs). They can be performed orthodromically in the direction of normal nerve conduction, or antidromically in the distal part of major peripheral nerves. The primary goals of sensory nerve conduction studies are the assessment of (1) the number of functioning axons (amplitude of SNAPs), and (2) the state of myelin in these axons (conduction velocity of SNAPs). In patients with axonal degeneration neuropathies (i.e., injury after injection into a nerve fascicle or diabetic neuropathy), the primary feature is a markedly reduced sensory action potential amplitude. Under these circumstances, the conduction velocity may be slightly reduced, but only to the extent that the largest axons are gone. In contrast, demyelinating neuropathies (i.e., tourniquet compression or Guillain-Barre Syndrome) generally cause profound abnormalities in conduction velocity, with or without alterations in action potential amplitude

Sensory nerve conduction study :This represents conduction impulse along the sensory nerve fibres

It is performed by electrical stimulation of the peripheral nerve and recording from a purely sensory portion of the nerve such as on a finger

The recording electrode is placed proximal to the stimulating electrode

Like the motor studies sensory latencies are on the scale of milliseconds

The sensory amplitude are much smaller than the motor amlplitude microvolts

The sensory conduction is measured in latency and distance between stimulating and recording electrode

SENSORY NERVE CONDUCTION STUDY SITES

Median nerves (R & L) at;

- index finger
- thumb

Ulnar nerves (R & L) at;

- little finger
- ring finger

Sural nerves (R & L) at;

- behind the Lateral Malleolus

Saphenous nerves(R & L) at;

- anterior to the Medial Malleolus

Motor nerve conduction: This represents conduction impulse along the peripheral motor nerve

This recorded as a compound evoked potential from a motor point within the muscle

The time it takes for electric impulse to travel from stimulation to the recording electrode is measured

This called latency and measured in milliseconds

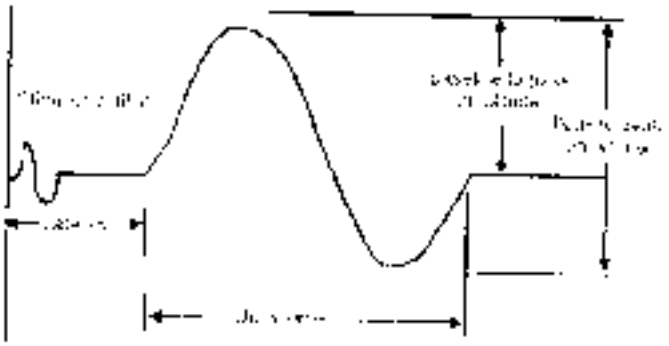
The size of responds called amplitude and measured in millivolts

By stimulating in two or more different locations along the same nerve ,NCV across different segments can be measured

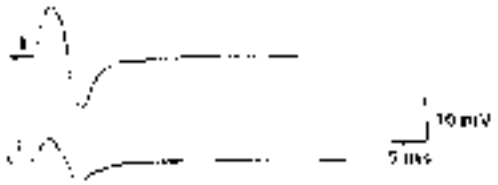
It corresponds to the integrity of the motor unit but cannot distinguish between pre and post ganglionic lesions because the cell body is located in the spinal cord

It can be abnormal with normal SNAPs if the lesion is proximal to the DRG or affecting a purely motor nerve

The active and reference pickup should not be too close together if this occur similar waveforms are recorded at both sites and rejected, dropping the amplitude of the wave form



Compound Motor Action Potential



effect on the amplitude of varying the inter electrode separation.
I: Normal.
II: Pickups are too close

MOTOR NERVE CONDUCTION STUDY SITES:

Median nerves (R & L) at;

- Wrist
- Elbow

Abductor Pollicis Brevis

Ulnar nerves (R & L) at;

- Wrist
- Elbow

First Dorsal Interosseous (FDI)
Abductor Digiti Minimi (ADM)

Peroneal nerves (R & L) at;

- Ankle
- Head of fibula

Extensor Digitorum Brevis
Tibialis Anterior

Tibial nerves(R & L) at;

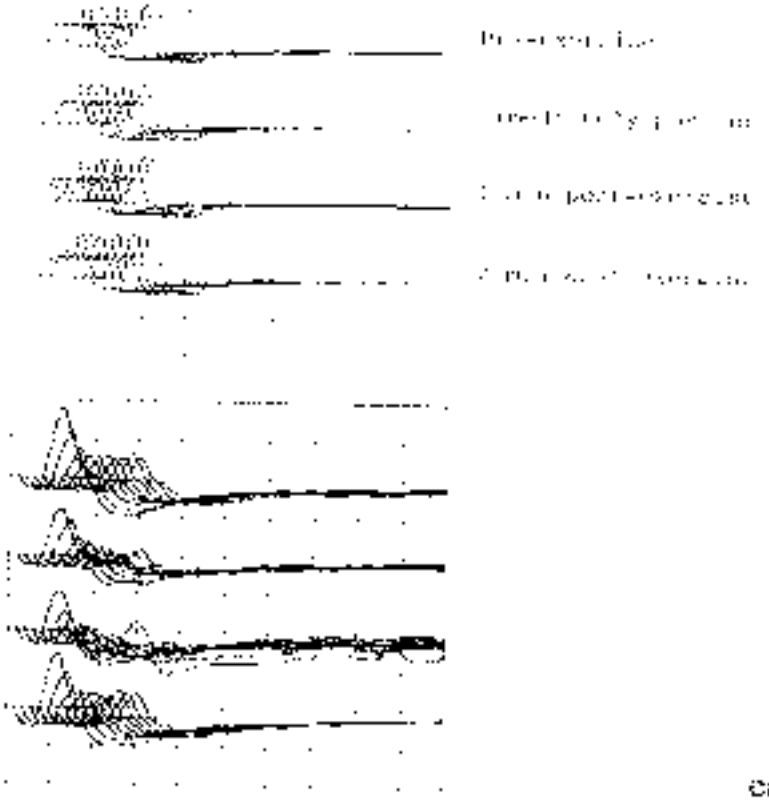
- Ankle

Abductor Hallucis
Abductor Digiti Quinti Pedis

REPETITIVE NERVE STIMULATION

Repetitive nerve stimulation (RNS) is used in the evaluation of patients with suspected neuromuscular transmission disorders (NMTD) such as myasthenia gravis (MG) or Lambert-Eaton myasthenic syndrome (LEMS). RNS is a modified motor NCS where instead of recording CMAPs with single supramaximal electrical stimuli, a train of 8–10 stimuli is applied and the sequential response amplitudes and/or areas measured. This may be carried out at low (3–4 Hz) or high frequency stimulation (20–50 Hz). In the latter case the train is prolonged to allow 2–10 seconds of continuous data to be measured. Both distal and proximal muscles/nerves should be studied in every patient suspected of an NMTD as the sensitivity of the test is greatly increased by this means.

With low frequency stimulation in normal subjects, the CMAP amplitude and/or area falls over the first 4–5 stimuli by a maximum of 10–12%. The maximum fall should be between potentials 1 and 2 (see RNS pitfalls). A number of department specific protocols have been published to study the RNS over time both before and after a period of maximum voluntary contraction of the muscle to pick up



early or late NMT failure (fig 7).

TECHNIQUE

The nerve conduction study consists of the following components

- Motor NCS
- Sensory NCS
- F wave study
- H-reflex study

The nerve conduction study is often combined with needle *electromyography*.

Other

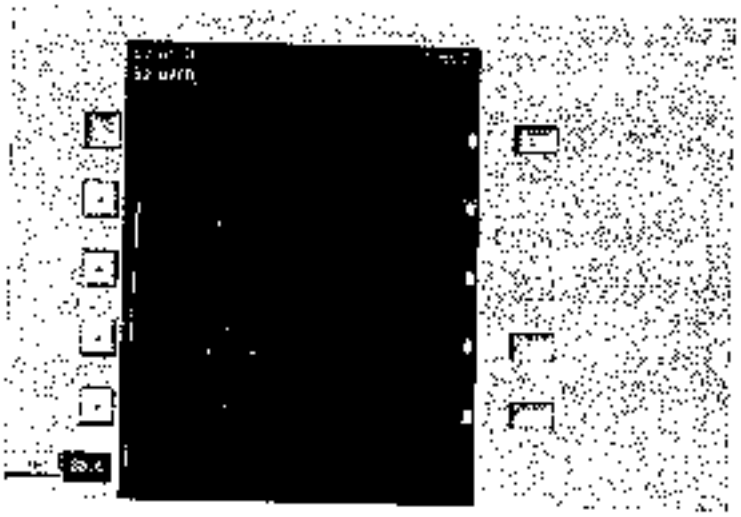
The Department of Health and Human Services Inspector General recently identified the use of NCSs without a needle electromyography at the same time a sign of questionable billing.[6]

Motor NCS

Motor NCS Motor NCS are obtained by stimulating a motor nerve and recording at the belly of a muscle innervated by that nerve. The CMAP is the resulting response, and depends on the motor axons transmitting the action potential, status of the neuromuscular junction, and muscle fibers. The CMAP amplitudes, motor onset latencies, and conduction velocities are routinely assessed and analyzed. As with sensory NCS, conduction velocity is calculated by dividing distance by time. In this case, however, the distance between two stimulation sites is divided by the difference in onset latencies of those two sites, providing the conduction velocity in the segment of nerve between the two stimulation sites. This method of calculating conduction velocity thereby avoids being confounded by time spent traversing the neuromuscular junction and triggering a muscle action potential (since these are subtracted out).

Sensory NCS

Sensory NCS are performed by electrical stimulation of a peripheral nerve while recording the transmitted potential at a different site along the same nerve. Three main measure can be obtained SNAP (Sensory nerve action potential)amplitude, sensory latency and conduction velocity. The SNAP amplitude (in microvolts) represents a measure of the number of axons conducting between the stimulation site and the recording site. Sensory latency (in milliseconds) is the time that it takes for the action potential to travel between the stimulation site and the recording site of the nerve. The conduction velocity is measured in meters per second and is obtained dividing the distance between stimulation site and the recording site by the latency: Conduction velocity = Distance/Latency



Sensory NCS: An example screenshot showing the results of a sensory nerve conduction velocity study of the right median nerve.

F-wave study

F-wave study uses supramaximal stimulation of a motor nerve and recording of action potentials from a muscle supplied by the nerve. This is not a reflex, per se, in that the action potential travels from the site of the stimulating electrode in the limb to the spinal cord's ventral horn and back to the limb in the same nerve that was stimulated. The F-wave latency can be used to derive the conduction velocity of nerve between the limb and spine, whereas the motor and sensory nerve conduction studies evaluate conduction in the segment of the limb. F waves vary in latency and an abnormal variance is called "chrono dispersion". Conduction velocity is derived by measuring the limb length, D, in millimeters from the stimulation site to the corresponding spinal segment (C7 spinous process to wrist crease for median nerve). This is multiplied by 2 as it goes to the cord and returns to the muscle (2D). 2D is divided by the latency difference between mean F and M and 1 millisecond subtracted (F-M-1). The formula is

H-reflex study

H-reflex study uses stimulation of a nerve and recording the reflex electrical discharge from a muscle in the limb. This also evaluates conduction between the limb and the spinal cord, but in this case, the afferent impulses (those going toward the spinal cord) are in sensory nerves while the efferent impulses (those coming from the spinal cord) are in motor nerves. This process cannot be changed.

Procedure:

Procedure for motor study:

Active electrode placed on the center of the muscle belly (over the motor end plate)

Ground electrode:in between active and recording electrode

Stimulator/recording electrode is placed over the nerve that supplies the muscle,cathode closest to the recording electrode

Current needed

15-35 mA for motor NCS

<20 mA for sensory NCS

Supramaximal stimulation is given in motor studies

Components of NCS:

Compound nerve actions potential

F-wave study

H reflex study

Motor conduction study Belly -tendon montage

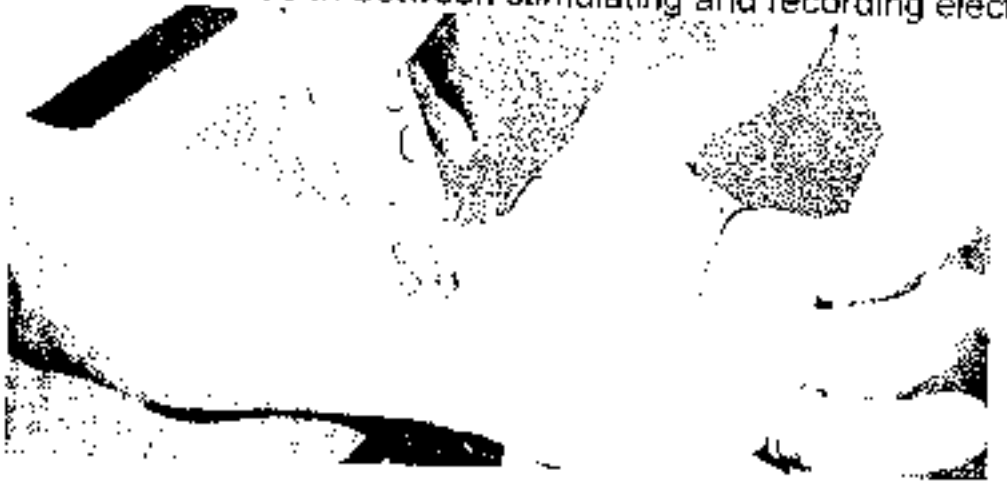
Active recording electrode is placed on the center of the muscle belly(over the motor endplate)

Reference electrode(G2) is distally .over the tendon to the muscle

Stimulator: Placed over the nerve that supplies the muscle

Cathode placed closest to the recording electrode

Ground electrode:In between stimulating and recording electrode



Normal values for NCS

Age matched "Normal" values for NCS parameters are either derived from studies of groups of neurologically normal subjects or culled from the literature. Regrettably in the view of the authors the most frequent statistics used are limits of 95% or less frequently 99% confidence limits of a normal group to indicate abnormality of a single parameter.

This approach may mislead as a crude separation between "normal" and "abnormal" dilutes the information whereas a Z score, for example, indicating the separation between a single value and the group mean expressed in SD, may be more informative. Alternatively, (a) a number of electrophysiological parameters may be taken together either as an "index" or "score", or (b) the neurophysiologist assesses a number of parameters together to make a judgement as to whether a clinically relevant numerical abnormality should be emphasised in the report interpretation or not.

There are a number of physical parameters that require correction or allowance for. The most important is temperature. The fastest motor nerve conduction velocity (FMNCV) is reduced by approximately 1 m/s per °C temperature fall. Conventionally, studies are performed as close to a surface recorded temperature of 34 °C. If that is not achieved by adequate heating of the limb, rarely a temperature correction must be applied. Some measures of conduction require correction for limb length or height. Finally nerve conduction data alter with age. The motor conduction slows by 0.4 - 1.7 m/s per decade after 20 years and the sensory by 2 - 4 m/s.

Precautions:

Follow general precautions

Failure to get response may be due to defect in stimulating or recording system

Laboratory temperature should be maintained preferably between 21-23° C

Interpretation of nerve conductions

The interpretation of nerve conduction studies is complex and requires the expertise of health care practitioners such as clinical neurophysiologists, medical neurologists, physical therapists, chiropractic neurologists or physiatrists. In general, different pathological processes result in changes in latencies, motor, and/or sensory amplitudes, or slowing of the conduction_velocities to differing degrees. For example, slowing of the NCV usually indicates there is damage to the myelin. Another example, slowing across the wrist for the motor and sensory latencies of the median nerve indicates focal compression of the median nerve at the wrist, called carpal tunnel syndrome. On the other hand, slowing of all nerve conductions in more than one limb indicates generalized diseased nerves, or generalized peripheral neuropathy. People with diabetes mellitus often develop generalized peripheral

neuropathy.

Basic Interpretations

- Amplitude: related to the # of axons in a nerve
- Latency: a marker of time; therefore, most affected by demyelinating processes i Conduction velocity: speed; can be affected by both axonal loss and demyelination
- Large, fast conducting fibers are lost
- Moderate slowing
- Demyelination
- Marked slowing

The speed of nerve conduction is related to

- Diameter of the nerve and ,
- Degree of myelination
- Normally functioning nerve will transmit a stronger and faster signal than a damaged nerve
- In general the range of normal conduction velocity will be approximately 50-60 meters per second ,however the normal conduction velocity may vary from one individual to another

Artifacts and technical errors

Temperature : cooler temperature prolong time of depolarization

Conduction velocity slows between 1.5-2.5m/sec distal latency prolong by 0.2ms for every degree drop in temperature

Higher amplitude and longer duration

Temperature to be maintained between 32-34^{0}

Age : conduction decrease with age

More prominent after 60 years

Correction factor 0.5-4m/sec for older patient can be used

Sural nerve cannot be elicitable for some

Height :Taller individual have slower conduction velocity

Adjustment no more than 2-4m/sec below lower limit of normal

Proximal vs distal : proximal nerve segmen conduct slightly faster than distal

Non physiological factors

Electrical impedence

Stimulus artifact :reduced by placement of ground between recording and stimulator

Decrease electrical impedence

Coaxial electrodes

Stimulator directly over nerve

Lower stimulus

Rotate anode while maintaining cathode

Stimulator and recording cables do not overlap

Cathode position reversed : theoretical possibility of anodal block

Distal latency prolonged by 0.3 -0.4 ms

Slowing sensory CV by 10m/sec

Costimulation of adjacent nerves : can be reduced by

Stimulator directly over the nerve

Watch for abrupt change in waveform change in resultant muscle twitch

Avoid exces current

Corecord muscles simultaneously from adjacent nerves

Cardinal rules of NCS: NCS are extension of clinical examination annot be performed without a good clinical examination

When in doubt always think about a technical factor

When in doubt reexamine the patient

When in doubt do not overcall a diagnosis

Always think about clinical eletrophysiological correlation

Protocol for evaluating disorders of neuromuscular junction

warm the extremity

immobilize the muscle as best as possible

perform routine motor nerve conduction studies first to ensure that the nerve is normal

perform RNS at rest,after making sure that the stimulus is supramaximal,perform 3-HZ RNS at rest for 5-10 impulses repeated three times,1 minute apart. Normally, there is <10% decrement between the first and fourth responses .

if >10% decrement occurs and is consisitently reproducible

-have the patient perform maximal voluntary exercise for 10 seconds

Immediately repeat 3- HZ RNS postexercise to demonstrate pose exercise facilitation and repair of the decrement

If <10% decrement or no decrement occurs

Have the patient perform maximal voluntary exercise for 1 minute then perform 3HZ RNS IMMEDIATELY AND 1,2,3 AND 4 minutes after exercise to demonstrate postexercise exhaustion

If a significant decrement occurs .have the patient perform maximum voluntary exercise again for 10 seconds and immediately repeat 3HZ RNS to demonstrate repair of the decrement

Perform RNS on one distal and one proximal motor nerve .always try to study weak muscles

If the compound muscle action potential amplitude is low at bacline.have the patient perform 10 seconds of maximal voluntary exercise, then stimulate the nerve supramaxiamally immediately posteexercise, looking for an abnormal increment(>40% above the baseline)

If the patient exercises fo r >10 seconds or the nerve is not stimulated immediately post exercise . a potential increment may be missed .

Always perform concentric needle EMG of proximal and distal muscle especially of clinically week muscles . any muscle with denervation or myotonia o9n needle EMG may demonstrate a decreemnt of RNS .in this situation decrement of RNS does not signify a primary disorder of the neuromuscular junction

FACTORS AFFECTING NERVE CONDUCTION VELOCITY

In general

Greater the diameter of a given nerve fibre,the greater is its speed of conduction

In myelinated fibres,the speed of conduction is about 6 times the fibre diameter

In unmyelinated fibres,the speed of conduction is proportional to the square root of the diameter

Age:at birth the nerve conduction velocity is half of adult value it attains adult value by 3-5years decline slowly after 30-40years of age

Temperature:within physiological limit conduction velocity varies directly with temperature

Length of the nervecan inverse relationship exists between length of the nerve and conduction velocity longer the nerve slower will be the conduction velocity

Myelination myelin thickness is inversely related to intermodal capacitance and conductance.conduction velocity,therefore increased in increase myelin

Diseases:segmental demyelination or during demyelination results in conduction block

In focal compression conduction velocity slows down due to demyelinaion and decrease in fibre diameter

PATIENTS RISK AND COMPLICATIONS

Nerve conduction studies are very helpful to diagnose certain diseases of the nerves of the body. The test is not invasive, but can be painful due to the electrical shocks. The shocks are associated with a low amount of electric current so they are not dangerous to anyone. Patients with a permanent pacemaker or other such implanted stimulators such as deep brain stimulators or spinal cord stimulators must tell the examiner prior to the study. This does not prevent the study, but special precautions are taken.

Cardiac pacemakers and implanted cardiac defibrillators (ICDs) are used increasingly in clinical practice, and no evidence exists indicating that performing routine electrodiagnostic studies on patients with these devices pose a safety hazard. However, there are theoretical concerns that electrical impulses of nerve conduction studies (NCS) could be erroneously sensed by devices and result in unintended inhibition or triggering of output or reprogramming of the device. In general, the closer the stimulation site is to the pacemaker and pacing leads, the greater the chance for inducing a voltage of sufficient amplitude to inhibit the pacemaker. Despite such concerns, no immediate or delayed adverse effects have been reported with routine NCS.

No known contraindications exist from performing needle EMG or NCS on pregnant patients. In addition, no complications from these procedures have been reported in the literature. Evoked potential testing, likewise, has not been reported to cause any problems when it is performed during pregnancy.

Summary and recommendations:

- Easily tolerated, safe
- Must be consistent in technique
- Intralab normal values
- Monitor for technical issues
- Very sensitive to axonal loss
- Very specific for demyelinating diseases

Annexure 2

Bharath Institute of Higher Education and Research SIMS

List of Students Enrolled

Participant list of Value added course: **certificate course on nerve conduction study and its application**

Sl.No	Reg.No	Name of the candidate	Signature
1	U18MB381	SUHAIL AHMAD	
2	U18MB382	SUMAN KALYAN SAHOO	
3	U18MB383	SUSMITA KHAN	
4	U18MB384	SWAPNIL	
5	U18MB385	SWARNAB JANA	
6	U18MB386	SWATHI.K	
7	U18MB387	TADAR YAMING	
8	U18MB388	TECHI NADAM	
9	U18MB389	THENDRAL NILAVAN .M	
10	U18MB390	TINA CAROLINE J	
11	U18MB391	URVASHI PAL	
12	U18MB392	VAISHNAVI TRIPATHI	
13	U18MB393	VARSHITHA.N	
14	U18MB394	VIKAASH.M	
15	U18MB395	VIKAS SHORAN	
16	U18MB396	VIKRANT SINGH	
17	U18MB397	K.C VINITHA	
18	U18MB398	VISWAS ANIL	
19	U18MB399	WARADKAR ANJUSHA DEEPAK	
20	U18MB400	YASHWANTH NAIK R	

Annexure 3

MCQS

1. For sensory conduction studies, the gain is ustally set at:

A. 1 μV

B. 20 μV

C. 100 μV

D. 200 μV

2. The following statements are correct except:

A. The recording electrodes are placed in line over the nerve with an interelectrode distance of 3 to 4 cm

B. Most sensory nerves require a current in the range of 5 to 30 mA to achieve supramaximal stimulation

C. Sensory nerves require a higher threshold for stimulation than do motor fibers

D. In sensory studies, a conduction velocity can be calculated using one stimulation site alone

3. Antidromic recording of sensory nerves is superior to orthodromic technique because:

A. Amplitude is higher using antidromic stimulation

B. The electrodes are closer to the nerve

C. It is less subject to noise or other artifact

D. The entire nerve is stimulated including the motor fibers

4. Myelinated fibers conduct at a velocity of approximately:

A. 100 m/s

B. 65 m/s

C. 50 m/s

D. 10 m/s

5. Demyelination is associated with:

A. Marked slowing of conduction velocity (slower than 85% of the lower limit of normal)

B. Marked prolongation of distal latency (longer than 110% of upper limit of normal)

C. Low compound motor action potential (CMAP) amplitude

D. Drop in amplitude in proximal stimulation compared to the distal stimulation

6. Routine nerve conduction studies are normal in ____% of patients with clinical symptoms and signs of carpal tunnel syndrome.

A. 5%

B. 20%

C. 30%

D. 40%

7. Carpal tunnel syndrome electrodiagnostic studies usually show (see A. Higher amplitude of median CMAP compared to ulnar nerve

B. The median nerve orthodromic absolute onset sensory latency is delayed by 3.7 ms

C. The median nerve orthodromic sensory latency is delayed by 2.0 ms compared to the ulnar nerve sensory distal latency

D. The median nerve orthodromic sensory latency is delayed by 0.2 ms compared to the ulnar nerve sensory distal latency

8. Median- versus ulnar-comparison tests are good tests to confirm carpal tunnel syndrome for the following reasons except:

A. They create an ideal internal control

B. Distance is different

C. Temperature is constant

D. Nerve fiber size is constant

9. Median- versus ulnar-sensory nerve short latency midpalmar study comparison test is abnormal if the median latency is delayed by more than _____ the ulnar latency.

A. 0.1 ms

B. 0.2 ms

C. 0.3 ms

D. 0.4 ms

10. In a patient with right foot pain, a sural and plantar sensory response is unmeasurable. The lesion can be present in the following except:

A. Tarsal tunnel syndrome

B. Sciatic lesion

C. Lumbosacral plexus lesion

D. Peripheral neuropathy

11. All of the following statements are correct except:

A. Orthodromic stimulation of the plantar sensory nerve produce a small amplitude response

B. Bilateral absent plantar sensory responses in middle aged or older individuals have no significance

C. In suspected tarsal tunnel syndrome, one side abnormal plantar response is diagnostic of tarsal tunnel syndrome

D. Medial and lateral plantar sensory potentials are unobtainable even in healthy subjects

12. Small fiber peripheral neuropathy is seen in all of the following conditions except:

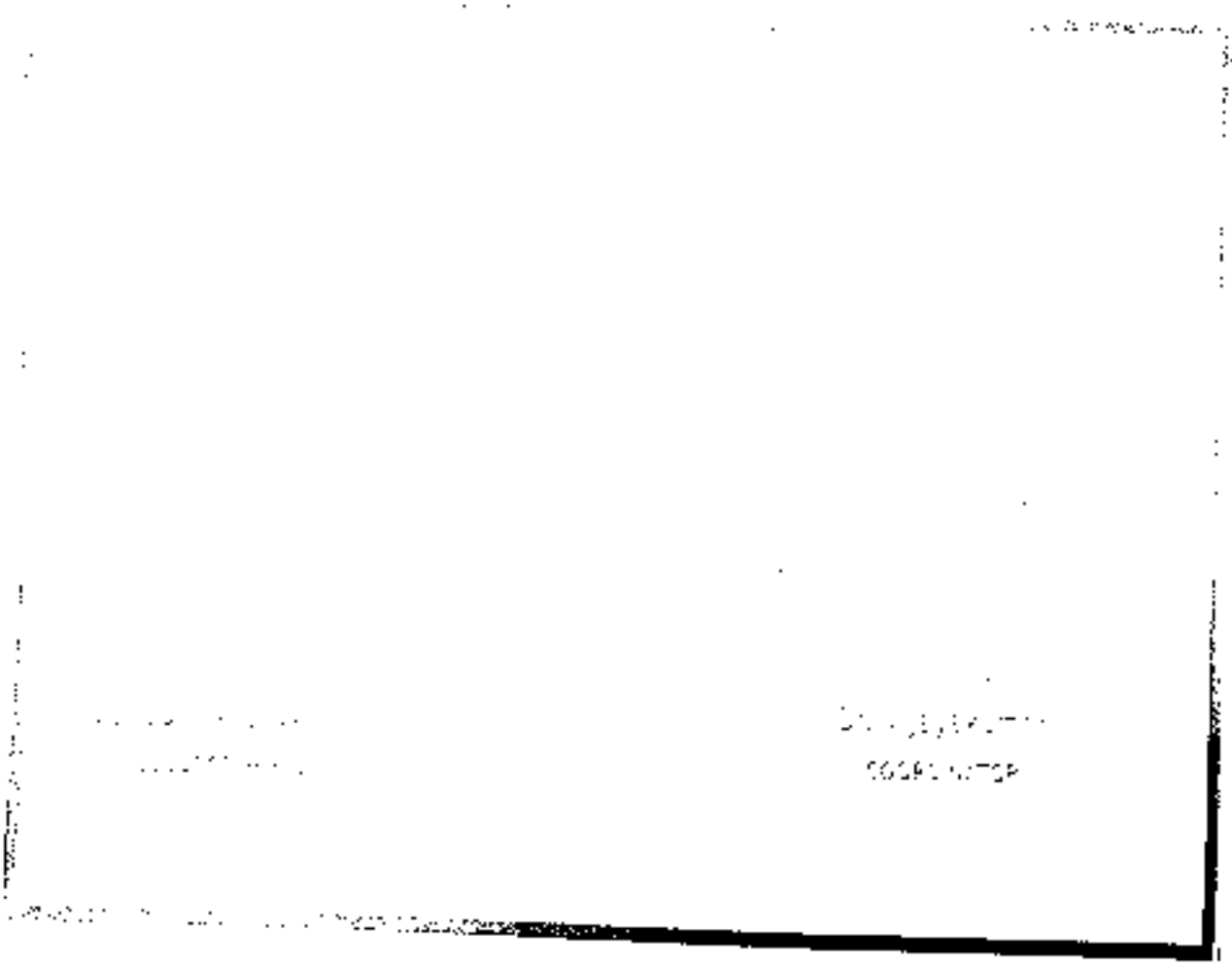
A. Diabetes

B. Fabry disease

C. Diphtheria

D. Tangier disease

Annexure 4



Sri Lakshmi Narayana Institute of Medical Sciences

This is to certify that _____ TECHI NADAR _____ has actively participated in the Certificate course in Value Added Course on nerve conduction study and its application during May 2018 - July 2018 Organized by Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry - 605 502, India.

B. Deiv

Dr. B. Deivanyagame
RESOURCE PERSON

Dr. Vijayakumar
COORDINATOR

Annexure 5

Course/Training Feedback Form

Course: [illegible]
Date: [illegible]
Name:
Reg NO. [illegible]
Department:physiology

Q 1: Please rate your overall satisfaction with the format of the course:

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 2: Please rate course notes:

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 3: The lecture sequence was well planned

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 4: The lectures were clear and easy to understand

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 5: Please rate the quality of pre course administration and information

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 6: Any other suggestions:

Comments: [illegible]

Thank you for taking the time to complete this survey, your comments are much appreciated

OPTIONAL Section: Name [illegible]
Signature [illegible] Date [illegible]

COURSE COMPLETION LETTER

Date 10.07.2018

From
B Deivanayagame.
Department of physiology,
SLIMS
Bharath Institute of Higher Education and Research,
Chennai.

Through Proper Channel

To
The Dean,
SLIMS
Bharath Institute of Higher Education and Research,
Chennai.

Sub: Completion of value-added course: certificate course on nerve conduction study and its application

Dear Sir,

With reference to the subject mentioned above, the department has conducted the value-added course titled: **certificate course on nerve conduction study and its application** on 08.07.2018 .We solicit your kind action to send certificates for the participants, that is attached with this letter. Also, I am attaching the photographs captured during the conduct of the course.
Kind Regards

Dr.B.Deivanayagame

Encl: Photographs

PHOTO