



# Clinical Neurophysiology 2nd Edition

Standard Operating Procedures  
For Assistant Medical Officer in Clinical Neurophysiology

Clinical  
Neurophysiology

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## 2nd Edition

Standard Operating Procedures  
For Assistant Medical Officer in Clinical Neurophysiology



Ministry of Health, Malaysia

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## FOREWORD



It is my great pleasure to be given the opportunity to write the foreword for the second edition of Clinical Neurophysiology Standard Operating Procedures (SOP) for Assistant Medical Officers (AMO).

There have been great strides in the field of Clinical Neurophysiology since the first edition was published in 2005 and this coupled with other advances in patient-care in general medicine and specifically, neurology has necessitated this publication of an updated manual.

I am sure that this updates will continue supporting the objectives of the first edition which is to provide guidance for the Assistant Medical Officers, especially the younger ones who are undertaking the specialized Course in Clinical Neurophysiology. It will also be useful review for the seniors in this field. Ultimately it is our aim to create a good work flow and provide better services to our clients.

May I congratulate the the Technical Committee as well as the Ministry of Health, Malaysia for immense effort put into this publication. I am sure it will go a long way in improving the quality of healthcare delivery in the field of neurophysiology.

A handwritten signature in black ink, appearing to be 'H. Rahman', written in a cursive style.

**Dato' Sri Dr. Hasan bin Abdul Rahman**  
Director General of Health, Malaysia  
August 2011

## FOREWORD



**A** successful outcome of any task requires a structured and systematic operational policy to guide and coming out the process.

First of all, I would like to congratulate the Technical Committee for preparing this concise Standard Operating Procedures (SOP) for various clinical neurophysiology tests. I am sure that the younger Assistant Medical Officers (AMO) will find this guidebook very useful for their daily clinical practice.

Neurologically trained Assistant Medical Officers play a very important role in facilitating the diagnosis of patients with a vast number of neurological conditions. Various neurophysiology tests eg. electroencephalography (EEG), evoked potential (EPs), polysomnography (PSG), etc. require not only skill and knowledge to perform but also a meticulous approach to the procedures involved.

Lastly, I would like to express my deep appreciation to the to the Technical Committee, panel reviewers and to all those who have contributed in making this publication of the second edition of the book a reality.

A handwritten signature in black ink, appearing to read 'Hisham', with a long horizontal flourish extending to the right.

**Datuk Dr. Noor Hisham bin Abdullah**  
Deputy Director General of Health (Medical)  
Ministry of Health, Malaysia  
August 2011

## MESSAGE



It gives me a great pleasure to write this message in the second edition of compilation of SOP (Standard Operating Procedure) for various tests in neurophysiology. We have made some editions from the first edition in 2005 to ensure its usefulness among the Assistant Medical Officer serving the various Neurophysiology Units in the Ministry of Health Malaysia.

Neurophysiological testing is one of the important diagnostic studies in neurology practice. This SOP will ensure standardised techniques, accurate results and hence the interpretation derived from such procedures. This is crucially important for further management of the patients with wide range of neurological disorders.

I would like to express my sincere appreciation and gratitude to all Assistant Medical Officer involved in the dynamic discussions, ideas, and references in preparing of this work manual. Finally, I would like to thank the Consultant Neurologists for their valuable input as the reviewers of this SOP.

Thank You

A handwritten signature in black ink, appearing to be 'Hanip bin Rafia', written in a cursive style.

**Dato' Dr. Md. Hanip bin Rafia**  
Advisor of Technical Committee  
Senior Consultant Neurologist, and  
Head of Department,  
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Kuala Lumpur Hospital

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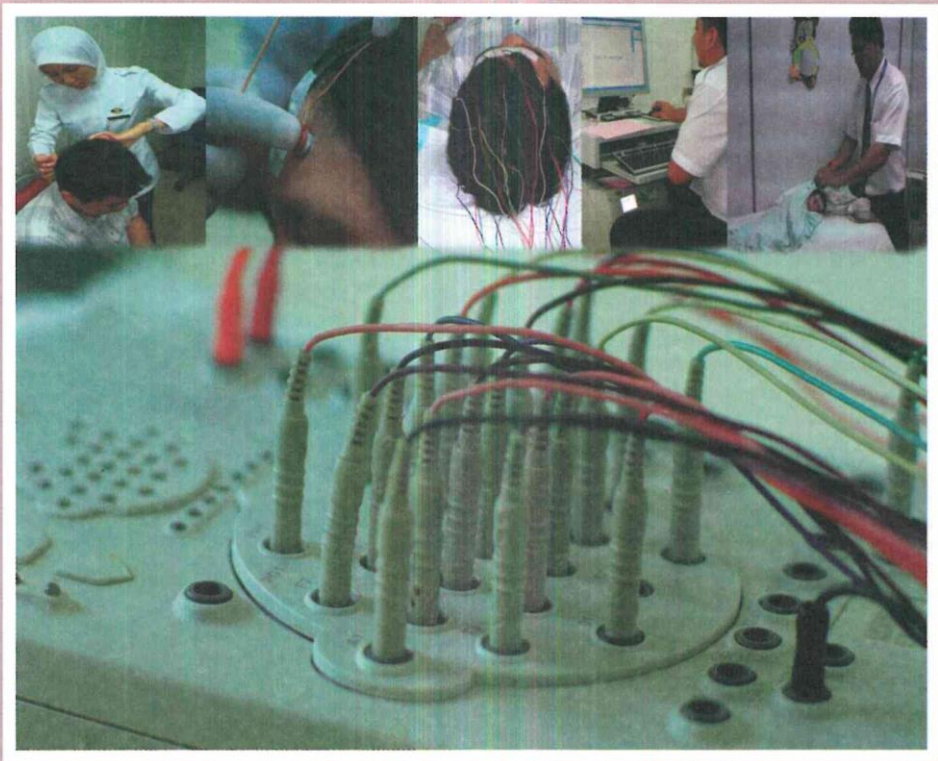
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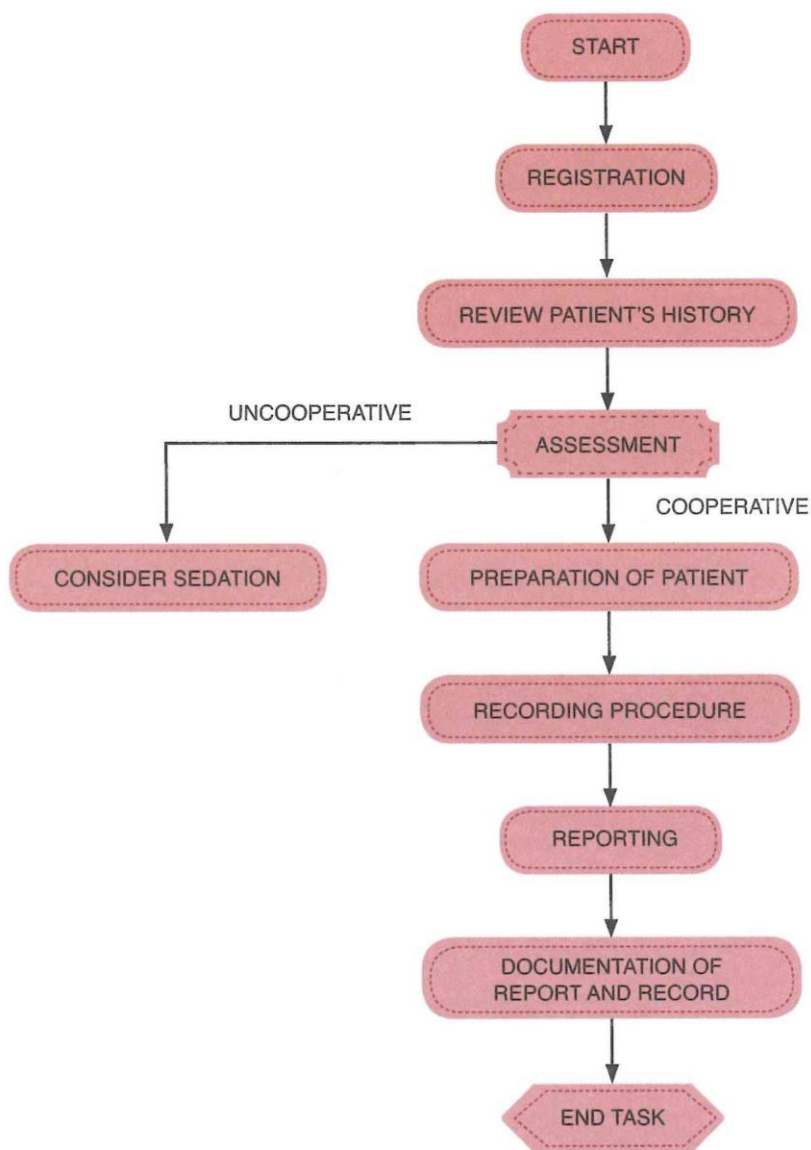
## **ELECTROENCEPHALOGRAPHY (EEG)**

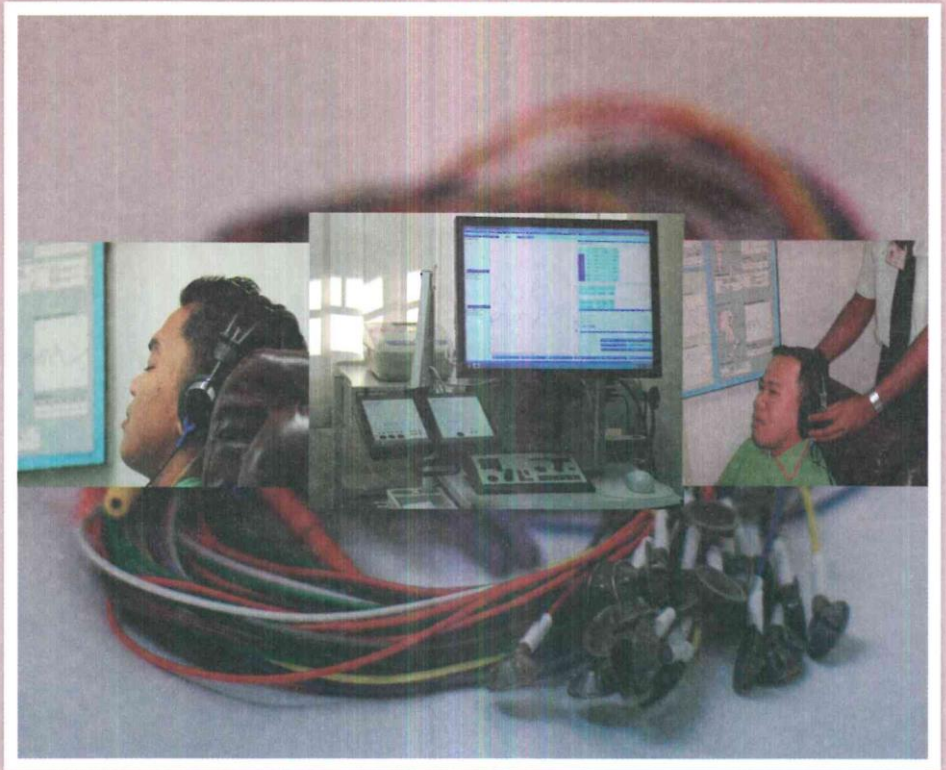
# 1. ELECTROENCEPHALOGRAPHY (EEG)

ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
1. Registration	<ol style="list-style-type: none"> <li>1. Receive appointment form</li> <li>2. Confirm patient schedule / appointment</li> <li>3. Register in the standard registration system</li> </ol>	<ol style="list-style-type: none"> <li>1. Name</li> <li>2. I/C number</li> <li>3. R/N</li> <li>4. Age</li> <li>5. Sex</li> <li>6. Race</li> <li>7. Address</li> <li>8. Phone number</li> <li>9. Diagnosis</li> <li>10. Date</li> </ol>	<ol style="list-style-type: none"> <li>1. EEG request card</li> <li>1. Registration book / system</li> </ol>
2. Review Patient's History	<ol style="list-style-type: none"> <li>1. Date of onset</li> <li>2. Last seizure</li> <li>3. Family history</li> <li>4. Medical/Surgical history</li> <li>5. Medication</li> <li>6. Previous EEG</li> </ol>	Trace old report (if any exist)	
3. Assessment	<ol style="list-style-type: none"> <li>1. Patient's general appearance &amp; mental status</li> </ol>	<ol style="list-style-type: none"> <li>1. Normal</li> <li>2. Alert</li> <li>3. Uncooperative</li> <li>4. Mentally challenged</li> <li>5. Confused</li> <li>6. Comatose</li> <li>7. Drowsy / Sleepy</li> <li>8. Sedated</li> <li>9. Aphasic</li> </ol>	<p><b>Drugs Available (sedative):</b></p> <ol style="list-style-type: none"> <li>1. Syrup Chloral Hydrate</li> <li>2. Cap. Melatonin</li> <li>3. Dormicum (IM / IV)</li> </ol>
4. Preparation of Patient	<ol style="list-style-type: none"> <li>1. Self - introduction (if applicable)</li> <li>2. Explain the procedure (if applicable)</li> <li>3. Obtain verbal consent (if applicable)</li> <li>4. Position and ensure the patient is comfortable</li> <li>5. Enter patient's demographic data in the system</li> <li>6. Measure, mark and gently degrease site with abrasive prepping gel</li> <li>7. Attach electrodes correctly and securely</li> </ol>	<p>Introduce yourself to patient/relative (if applicable)</p> <p>With chaperone (if required)</p> <p>10 - 20 International System</p>	<ol style="list-style-type: none"> <li>1. Measuring tape</li> <li>2. Dermatograph</li> <li>3. pencil</li> <li>4. Skin conditioner</li> <li>1. Gauze / Cotton</li> <li>2. EEG electrodes</li> <li>3. Micropore Paste</li> </ol>
5. Recording Procedure	<ol style="list-style-type: none"> <li>1. Perform Calibration (mechanical &amp; biological)</li> <li>2. Impedance check</li> <li>3. Record with appropriate montage</li> </ol>	<ol style="list-style-type: none"> <li>1. Sensitivity 100 <math>\mu</math>V</li> <li>2. HFF 70 Hz</li> <li>3. LFF 0.5 Hz</li> <li>4. Time base 30mm/sec</li> <li>5. 10 mm deflection at 100 <math>\mu</math>V sensitivity</li> </ol> <p>&lt; 5 k<math>\Omega</math> Minimum 20 minutes' recording</p>	<p><b>Equipments:</b></p> <ol style="list-style-type: none"> <li>1. EEG machine</li> </ol>

ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
	4. Activation Procedures  5. Annotation of events 6. Identify and eliminate or minimize biological and physical artifacts 7. Perform Calibration (biological & mechanical)  8. Remove all electrodes and paste, gently from patient's scalp 9. Clean the electrodes	1. Eyes open /Eyes close 2. Hyperventilation (minimum 3 mins HV and 2 mins post HV) 3. Photic stimulation with appropriate flashes 4. Sleep deprived (if required)  1. Sensitivity 100 $\mu$ V 2. HFF 70 Hz 3. LFF 0.5 Hz 4. Time base 30mm/sec 5. 10 mm deflection at 100 $\mu$ V sensitivity	1. Water 2. Sodium Hypochloride 5% (if infectious cases suspected)
6. Reporting	1. Compile EEG record 2. Fill up the comment slip  3. Prepare factual report (if required) 4. Send EEG record for reporting	AMO 1. Patient name 2. Patient IC 3. Patient RN 4. Patient age 5. Patient sex 6. Purpose 7. History 8. Hyperventilation 9. Photic stimulation 10. Medication 11. Type of procedure 12. EEG number 13. Date 14. Name of Physician 15. Name of AMO 16. AMO's comment 17. Patient's apparent and mental status 18. Skull defect 19. Old report (Y/N) 20. Old graph (Y/N)  Neurologist	1. Comment Slip
7. Documentation of report and record	1. Archive EEG record in the system 2. Despatch and file the report	Despatch book	

# FLOW CHART ELECTROENCEPHALOGRAPHY (EEG)





## **BRAINSTEM AUDITORY EVOKED POTENTIAL (BAEP)**

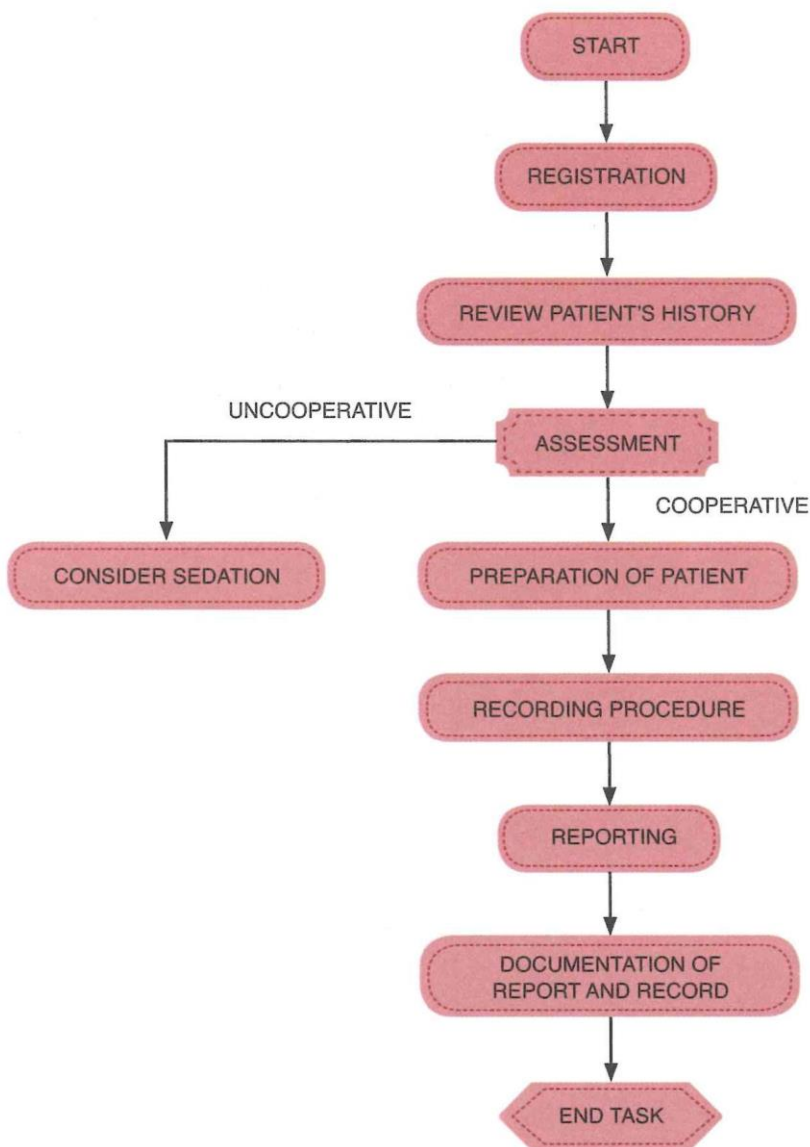
## 2. BRAINSTEM AUDITORY EVOKED POTENTIAL (BAEP)

ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
1. Registration	<ol style="list-style-type: none"> <li>1. Receive appointment form</li> <li>2. Confirm patient schedule / appointment</li> <li>3. Register in the standard registration system</li> </ol>	<ol style="list-style-type: none"> <li>1. Name</li> <li>2. I/C number</li> <li>3. R/N</li> <li>4. Age</li> <li>5. Sex</li> <li>6. Race</li> <li>7. Address</li> <li>8. Phone number</li> <li>9. Diagnosis</li> <li>10. Date</li> </ol>	<ol style="list-style-type: none"> <li>1. Evoked Potential (BAEP) request form</li> <li>1. Registration book / system</li> </ol>
2. Review Patient's History	<ol style="list-style-type: none"> <li>1. Date of onset</li> <li>2. Family history</li> <li>3. Medical/Surgical history</li> <li>4. Medication</li> <li>5. Previous BAEP</li> </ol>	Trace old report (if any exist)	
3. Assessment	<ol style="list-style-type: none"> <li>1. Patient's general appearance &amp; mental status</li> </ol>	<ol style="list-style-type: none"> <li>1. Normal</li> <li>2. Alert</li> <li>3. Uncooperative</li> <li>4. Mentally challenged</li> <li>5. Confused</li> <li>6. Comatose</li> <li>7. Drowsy /Sleepy</li> <li>8. Sedated</li> <li>9. Aphasic</li> </ol>	<p><b>Drugs Available (sedative):</b></p> <ol style="list-style-type: none"> <li>1. Syrup Chloral Hydrate</li> <li>2. Cap. Melatonin</li> </ol>
4. Preparation of Patient	<ol style="list-style-type: none"> <li>1. Self - introduction (if applicable)</li> <li>2. Explain the procedure (if applicable)</li> <li>3. Obtain verbal consent (if applicable)</li> <li>4. Position and ensure the patient is comfortable</li> <li>5. Enter patient's demographic data in the system</li> <li>6. Measure, mark and gently degrease site with abrasive prepping gel</li> </ol>	<p>Introduce yourself to patient/relative (if applicable)</p> <p>With chaperone (if required)</p> <p>10 - 20 International System</p>	<ol style="list-style-type: none"> <li>1. Measuring tape</li> <li>2. Dermatograph pencil</li> <li>3. Skin conditioner</li> <li>4. Gauze / Cotton</li> </ol>



ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
	7. Attach electrodes correctly and securely		1. BAEP electrodes 2. Micropore 3. Paste
5. Recording Procedure	1. Perform Calibration  2. Impedance check 3. Record with appropriate montage  4. Identify and eliminate or minimize biological and physical artifacts 5. Identify and mark waveform  6. Perform Calibration  7. Remove all electrodes and paste, gently from patient's scalp 8. Clean the electrodes	1. Sensitivity 20 $\mu V$ 2. HFF 100 Hz 3. LFF 1 Hz  < 5k $\Omega$ Check hearing threshold Start stimulation at 50dB above hearing threshold  Minimum two identical responses required for each ear  1. Sensitivity 20 $\mu V$ 2. HFF 100 Hz 3. LFF 1 Hz	<b>Equipments:</b> 1. EP machine          1. Water 2. Sodium Hypochloride 5% (if infectious cases suspected)
6. Reporting	1. Compile BAEP record 2. Prepare factual report (if required) 3. Send BAEP record for reporting	AMO  Neurologist	
7. Documentation of report and record	1. Archive BAEP record in the system 2. Despatch and file the report	Despatch book	

# FLOW CHART BRAINSTEM AUDITORY EVOKED POTENTIAL (BAEP)





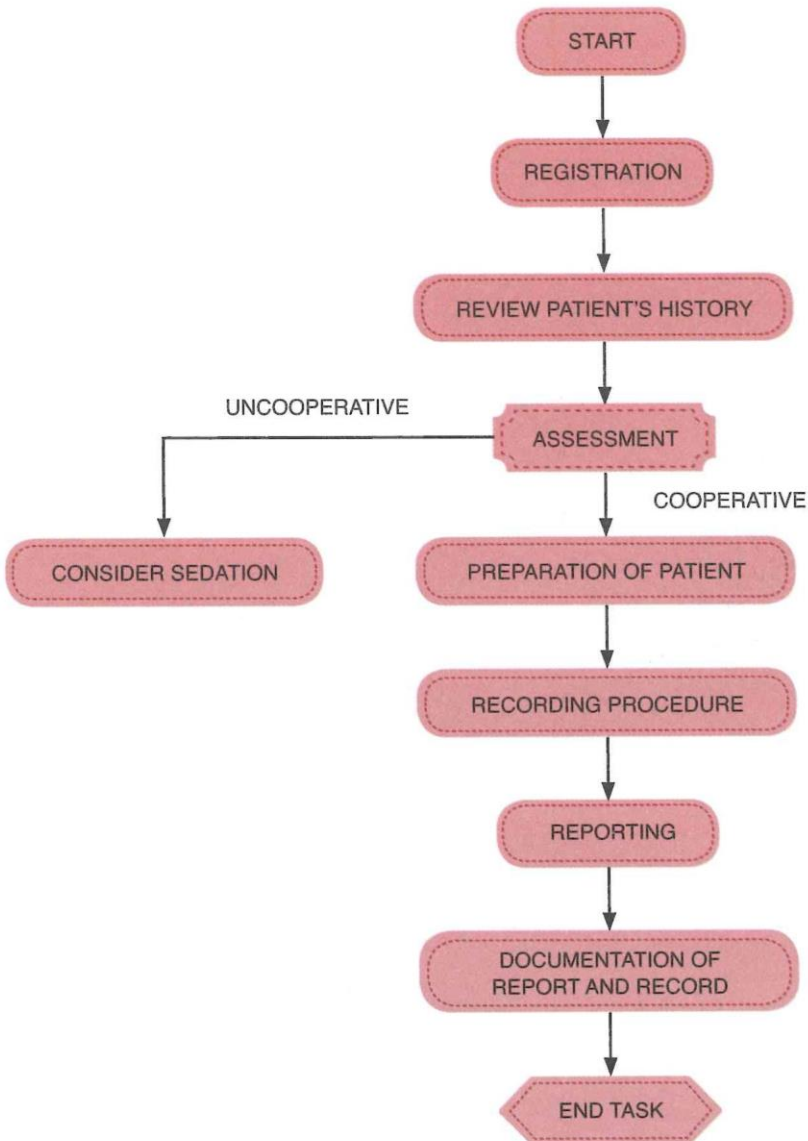
## **VISUAL EVOKED POTENTIAL (VEP)**

### 3. VISUAL EVOKED POTENTIAL (VEP)

ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
1. Registration	<ol style="list-style-type: none"> <li>1. Receive appointment form</li> <li>2. Confirm patient schedule / appointment</li> <li>3. Register in the standard registration system</li> </ol>	<ol style="list-style-type: none"> <li>1. Name</li> <li>2. I/C number</li> <li>3. R/N</li> <li>4. Age</li> <li>5. Sex</li> <li>6. Race</li> <li>7. Address</li> <li>8. Phone number</li> <li>9. Diagnosis</li> <li>10. Date</li> </ol>	<ol style="list-style-type: none"> <li>1. Evoked Potential (VEP) request form</li> <li>1. Registration book / system</li> </ol>
2. Review Patient's History	<ol style="list-style-type: none"> <li>1. Date of onset</li> <li>2. Family history</li> <li>3. Medical/Surgical history</li> <li>4. Medication</li> <li>5. Previous VEP</li> </ol>	Trace old report (if any exist)	
3. Assessment	<ol style="list-style-type: none"> <li>1. Patient's general appearance &amp; mental status</li> </ol>	<ol style="list-style-type: none"> <li>1. Normal</li> <li>2. Alert</li> <li>3. Uncooperative</li> <li>4. Mentally challenged</li> <li>5. Confused</li> <li>6. Comatose</li> <li>7. Drowsy /Sleepy</li> <li>8. Sedated</li> <li>9. Aphasic</li> </ol>	<p><b>Drugs Available (sedative):</b></p> <ol style="list-style-type: none"> <li>1. Syrup Chloral Hydrate</li> <li>2. Cap. Melatonin</li> </ol>
4. Preparation of Patient	<ol style="list-style-type: none"> <li>1. Self - introduction (if applicable)</li> <li>2. Explain the procedure (if applicable)</li> <li>3. Obtain verbal consent (if applicable)</li> <li>4. Position and ensure the patient is comfortable</li> <li>5. Enter patient's demographic data in the system</li> <li>6. Measure, mark and gently degrease site with abrasive prepping gel</li> <li>7. Attach electrodes correctly and securely</li> </ol>	<p>Introduce yourself to patient/relative (if applicable)</p> <p>With chaperone (if required)</p> <p>10 - 20 International System</p>	<ol style="list-style-type: none"> <li>1. Measuring tape</li> <li>2. Dermatograph pencil</li> <li>3. Skin conditioner</li> <li>4. Gauze / Cotton</li> <li>1. VEP electrodes</li> <li>2. Micropore</li> <li>3. Paste</li> </ol>

ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
5. Recording Procedure	<ol style="list-style-type: none"> <li>1. Perform calibration</li> <li>2. Impedance check</li> <li>3. Distance of patient's eyes to stimulus monitor / screen</li> <li>4. Use appropriate stimulus pattern</li> <li>5. Identify and eliminate or minimize biological and physical artifacts</li> <li>6. Identify and mark waveform</li> <li>7. Perform Calibration</li> <li>8. Remove all electrodes and paste, gently from patient's scalp.</li> <li>9. Clean the electrode</li> </ol>	<ol style="list-style-type: none"> <li>1. Sensitivity 20 <math>\mu</math>V</li> <li>2. HFF 100 Hz</li> <li>3. LFF 1 HZ</li> <li>&lt; 5k<math>\Omega</math></li> <li>1.5 meter</li> <li>1. Full field</li> <li>2. Flash</li> <li>3. Hemifield</li> <li>4. Start stimulation and record with appropriate side.</li> <li>Minimum two identical responses required for each eye</li> <li>1. Sensitivity 20 <math>\mu</math>V</li> <li>2. HFF 100 Hz</li> <li>3. LFF 1 Hz</li> </ol>	<p><b>Equipments:</b></p> <ol style="list-style-type: none"> <li>1. EP machine</li> <li>1. Water</li> <li>2. Sodium Hypochloride 5% (if infectious cases suspected)</li> </ol>
6. Reporting	<ol style="list-style-type: none"> <li>1. Compile VEP record</li> <li>2. Prepare factual report (if required)</li> <li>3. Send VEP record for reporting</li> </ol>	<p>AMO</p> <p>Neurologist</p>	
7. Documentation of report and record	<ol style="list-style-type: none"> <li>1. Archive VEP record in the system</li> <li>2. Despatch and file the report</li> </ol>	<p>Despatch book</p>	

# FLOW CHART VISUAL EVOKED POTENTIAL (VEP)





## **SOMATOSENSORY EVOKED POTENTIAL (SSEP – MEDIAN NERVE)**

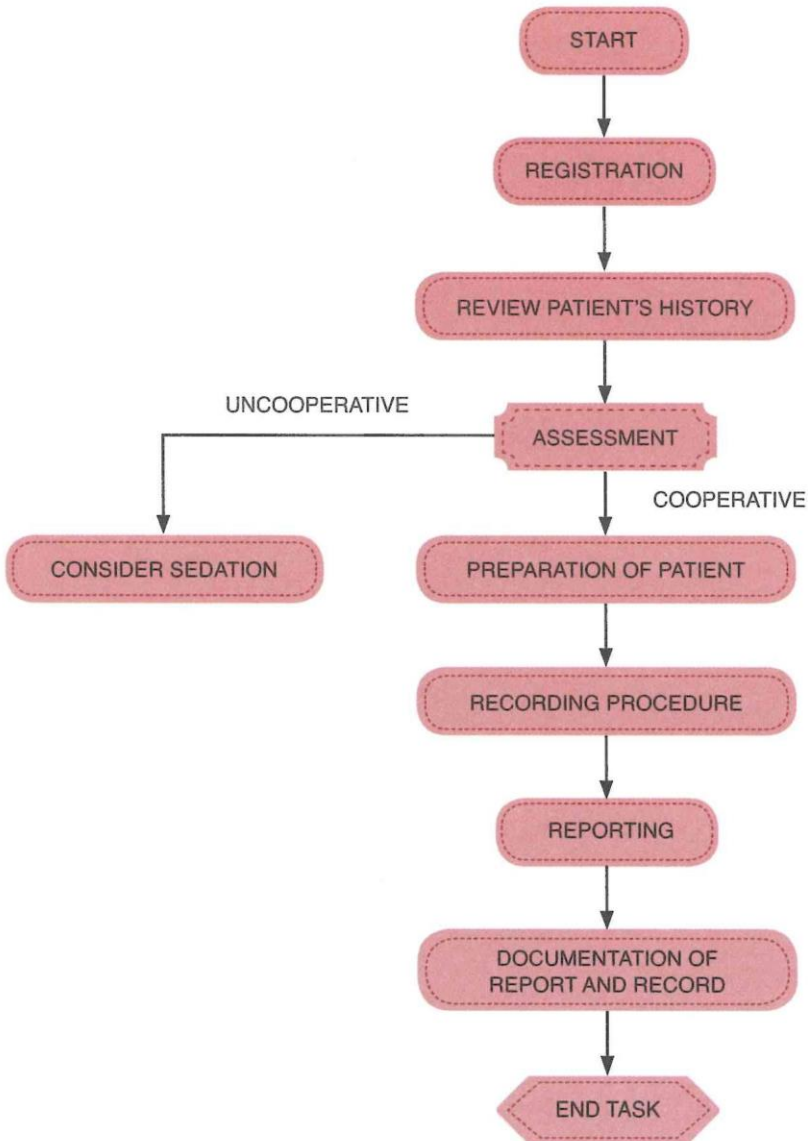
## 4. SOMATOSENSORY EVOKED POTENTIAL (SSEP) – MEDIAN NERVE

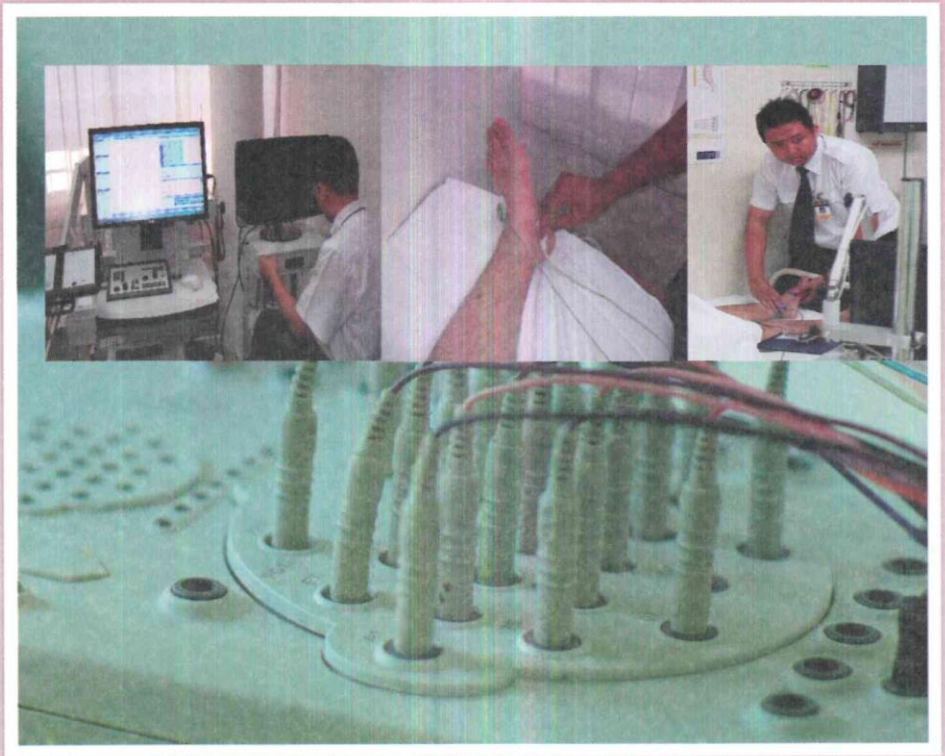
ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
1. Registration	<ol style="list-style-type: none"> <li>1. Receive appointment form</li> <li>2. Confirm patient schedule / appointment</li> <li>3. Register in the standard registration system</li> </ol>	<ol style="list-style-type: none"> <li>1. Name</li> <li>2. I/C number</li> <li>3. R/N</li> <li>4. Age</li> <li>5. Sex</li> <li>6. Race</li> <li>7. Address</li> <li>8. Phone number</li> <li>9. Diagnosis</li> <li>10. Date</li> </ol>	<ol style="list-style-type: none"> <li>1. Evoked Potential (SSEP – Median Nerve) request form</li> <li>1. Registration book / system</li> </ol>
2. Review Patient's History	<ol style="list-style-type: none"> <li>1. Date of onset</li> <li>2. Family history</li> <li>3. Medical/Surgical history</li> <li>4. Medication</li> <li>5. Previous SSEP – Median Nerve</li> </ol>	Trace old report (if any exist)	
3. Assessment	<ol style="list-style-type: none"> <li>1. Patient's general appearance &amp; mental status</li> </ol>	<ol style="list-style-type: none"> <li>1. Normal</li> <li>2. Alert</li> <li>3. Uncooperative</li> <li>4. Mentally challenged</li> <li>5. Confused</li> <li>6. Comatose</li> <li>7. Drowsy /Sleepy</li> <li>8. Sedated</li> <li>9. Aphasic</li> </ol>	<b>Drugs Available (sedative):</b> <ol style="list-style-type: none"> <li>1. Syrup Chloral</li> <li>2. Hydrate Cap. Melatonin</li> </ol>
4. Preparation of Patient	<ol style="list-style-type: none"> <li>1. Self - introduction (if applicable)</li> <li>2. Explain the procedure (if applicable)</li> <li>3. Obtain verbal consent (if applicable)</li> <li>4. Position and ensure the patient is comfortable</li> <li>5. Enter patient's demographic data in the system</li> <li>6. Measure, mark and gently degrease site with abrasive prepping gel</li> </ol>	<p>Introduce yourself to patient/relative (if applicable)</p> <p>With chaperone (if required)</p> <p>10 - 20 International System</p>	<ol style="list-style-type: none"> <li>1. Measuring tape</li> <li>2. Dermatograph pencil</li> <li>3. Skin conditioner</li> <li>4 Gauze / Cotton</li> </ol>



ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
	7. Attach electrodes correctly and securely		1. SSEP electrodes 2. Micropore 3. Paste
5. Recording Procedure	1. Perform calibration  2. Impedance check  3. Activation Procedures  4. Identify and eliminate or minimize biological and physical artifacts  5. Identify and mark waveform  6. Perform Calibration  7. Remove all electrodes and paste, gently from patient's scalp and limbs  8. Clean the electrodes	1. Sensitivity 20 $\mu$ V 2. HFF 100 Hz 3. LFF 1 Hz < 5k $\Omega$  Start recording by stimulating Median Nerve  Minimum two identical responses required for each limb  1. Sensitivity 20 $\mu$ V 2. HFF 100 Hz 3. LFF 1 Hz	<b>Equipments:</b> 1. EP machine              1. Water 2. Sodium Hypochloride 5% (if infectious cases suspected)
6. Reporti	1. Compile SSEP record 2. Prepare factual report (if required) 3. Send SSEP record for reporting	AMO   Neurologist	
7. Documentation of report and record	1. Archive SSEP tracing in the system 2. Despatch and file the report	Despatch book	

# FLOW CHART SOMATOSENSORY EVOKED POTENTIAL (SSEP) – MEDIAN NERVE





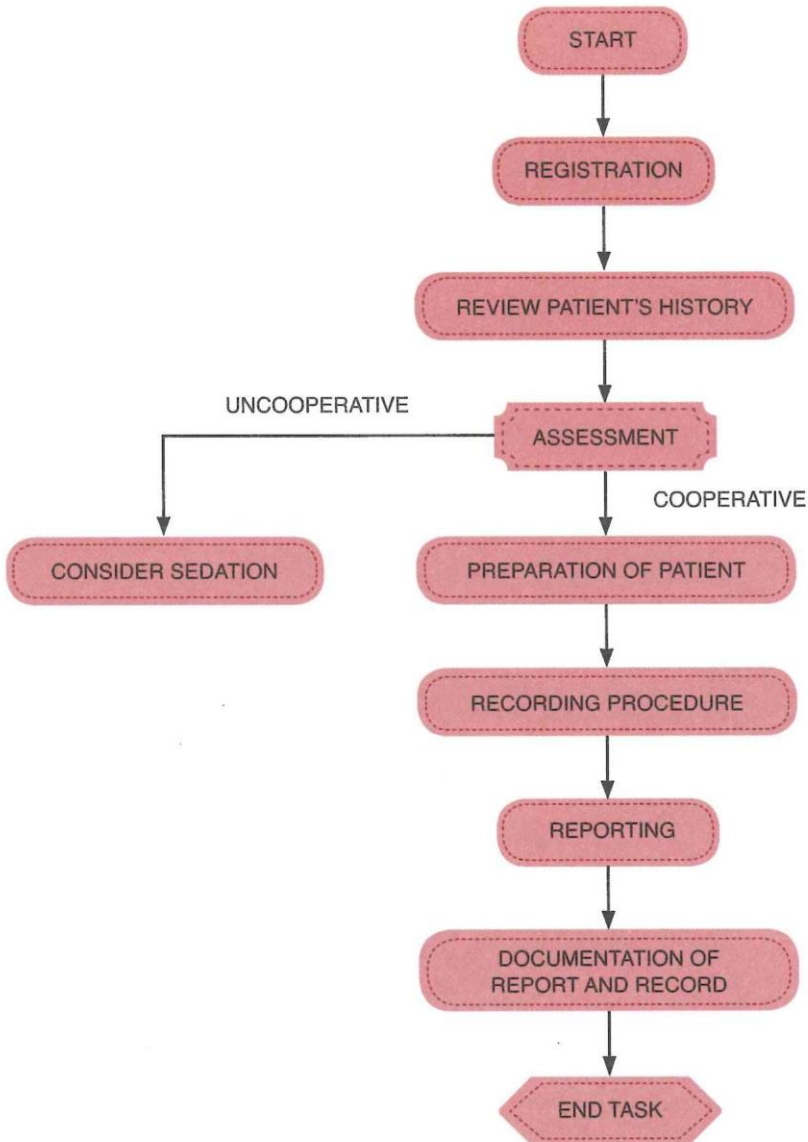
## **SOMATOSENSORY EVOKED POTENTIAL (SSEP – POSTERIOR TIBIAL NERVE)**

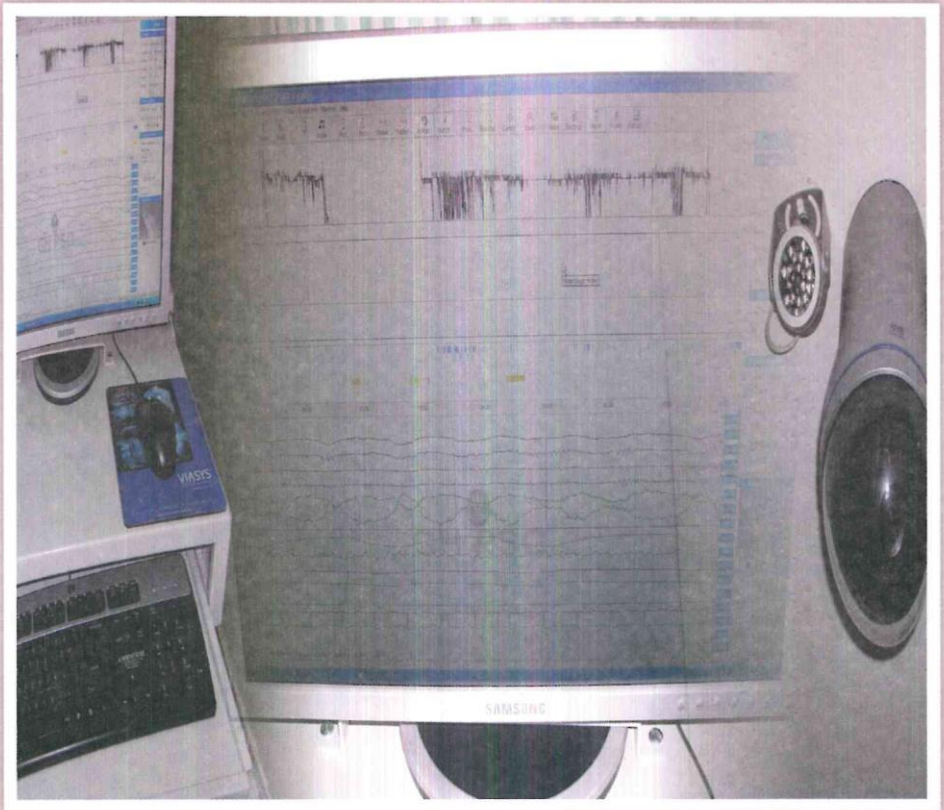
## 5. SOMATOSENSORY EVOKED POTENTIAL (SSEP) – POSTERIOR TIBIAL NERVE

ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
1. Registration	<ol style="list-style-type: none"> <li>1. Receive appointment form</li> <li>2. Confirm patient schedule / appointment</li> <li>3. Register in the standard registration system</li> </ol>	<ol style="list-style-type: none"> <li>1. Name</li> <li>2. I/C number</li> <li>3. R/N</li> <li>4. Age</li> <li>5. Sex</li> <li>6. Race</li> <li>7. Address</li> <li>8. Phone number</li> <li>9. Diagnosis</li> <li>10. Date</li> </ol>	<ol style="list-style-type: none"> <li>1. Evoked Potential (SSEP – Posterior Tibial Nerve) request form</li> <li>1. Registration book / system</li> </ol>
2. Review Patient's History	<ol style="list-style-type: none"> <li>1. Date of onset</li> <li>2. Family history</li> <li>3. Medical/Surgical history</li> <li>4. Medication</li> <li>5. Previous SSEP – Posterior Tibial Nerve</li> </ol>	Trace old report (if any exist)	
3. Assessment	<ol style="list-style-type: none"> <li>1. Patient's general appearance &amp; mental status</li> </ol>	<ol style="list-style-type: none"> <li>1. Normal</li> <li>2. Alert</li> <li>3. Uncooperative</li> <li>4. Mentally challenged</li> <li>5. Confused</li> <li>6. Comatose</li> <li>8. Drowsy /</li> <li>9. Sleepy</li> <li>Sedated</li> <li>Aphasic</li> </ol>	<p><b>Drugs Available (sedative):</b></p> <ol style="list-style-type: none"> <li>1. Syrup Chloral Hydrate</li> <li>2. Cap. Melatonin</li> </ol>
4. Preparation of Patient	<ol style="list-style-type: none"> <li>1. Self - introduction (if applicable)</li> <li>2. Explain the procedure (if applicable)</li> <li>3. Obtain verbal consent (if applicable)</li> <li>4. Position and ensure the patient is comfortable</li> <li>5. Enter patient's demographic data in the system</li> <li>6. Measure, mark and gently degrease site with abrasive prepping gel</li> <li>7. Attach electrodes correctly and securely</li> </ol>	<p>Introduce yourself to patient/relative (if applicable)</p> <p>With chaperone (if required)</p> <p>10 - 20 International System</p>	<ol style="list-style-type: none"> <li>1. Measuring tape</li> <li>2. Dermatograph pencil</li> <li>3. Skin conditioner</li> <li>4. Gauze / Cotton</li> <li>1. SSEP electrodes</li> <li>2. Micropore</li> <li>3. Paste</li> </ol>

ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
5. Recording Procedure	<ol style="list-style-type: none"> <li>1. Perform calibration</li> <li>2. Impedance check</li> <li>3. Activation Procedures</li> <li>4. Identify and eliminate or minimize biological and physical artifacts</li> <li>5. Identify and mark waveform</li> <li>6. Perform Calibration</li> <li>7. Remove all electrodes and paste, gently from patient's scalp and limbs</li> <li>8. Clean the electrodes</li> </ol>	<ol style="list-style-type: none"> <li>1. Sensitivity 20 <math>\mu</math>V</li> <li>2. HFF 100 Hz</li> <li>3. LFF 1 Hz</li> </ol> <p>&lt; 5k<math>\Omega</math> Start recording by stimulating Posterior Tibial Nerve</p> <p>Minimum two identical responses required for each limb</p> <ol style="list-style-type: none"> <li>1. Sensitivity 20 <math>\mu</math>V</li> <li>2. HFF 100 Hz</li> <li>3. LFF 1 Hz</li> </ol>	<p><b>Equipments:</b></p> <ol style="list-style-type: none"> <li>1. EP machine</li> <li>1. Water</li> <li>2. Sodium Hypochloride 5% (if infectious cases suspected)</li> </ol>
6. Reporting	<ol style="list-style-type: none"> <li>1. Compile SSEP record</li> <li>2. Prepare factual report (if required)</li> <li>3. Send SSEP record for reporting</li> </ol>	<p>AMO</p> <p>Neurologist</p>	
7. Documentation of report and record	<ol style="list-style-type: none"> <li>1. Archive SSEP record in the system</li> <li>2. Despatch and file the report</li> </ol>	<p>Despatch book</p>	

# FLOW CHART SOMATOSENSORY EVOKED POTENTIAL (SSEP) – POSTERIOR TIBIAL NERVE





## **POLYSOMNOGRAPHY (PSG)**

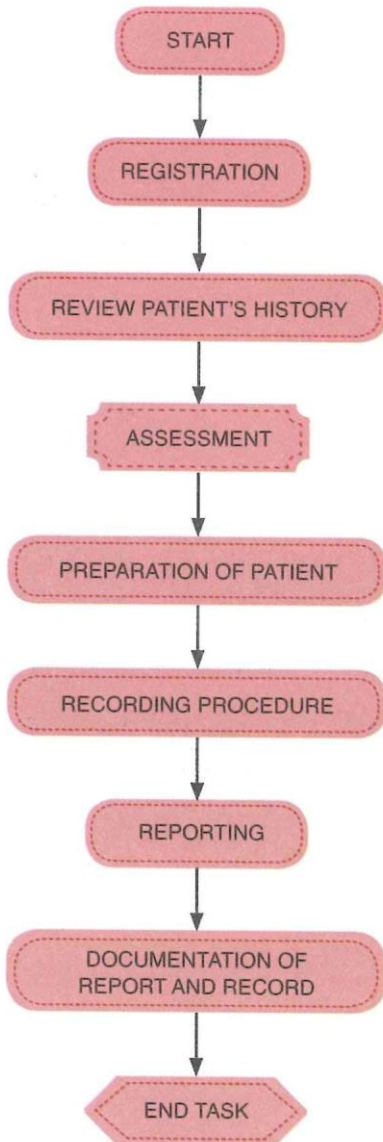
## 6. POLYSOMNOGRAPHY (PSG)

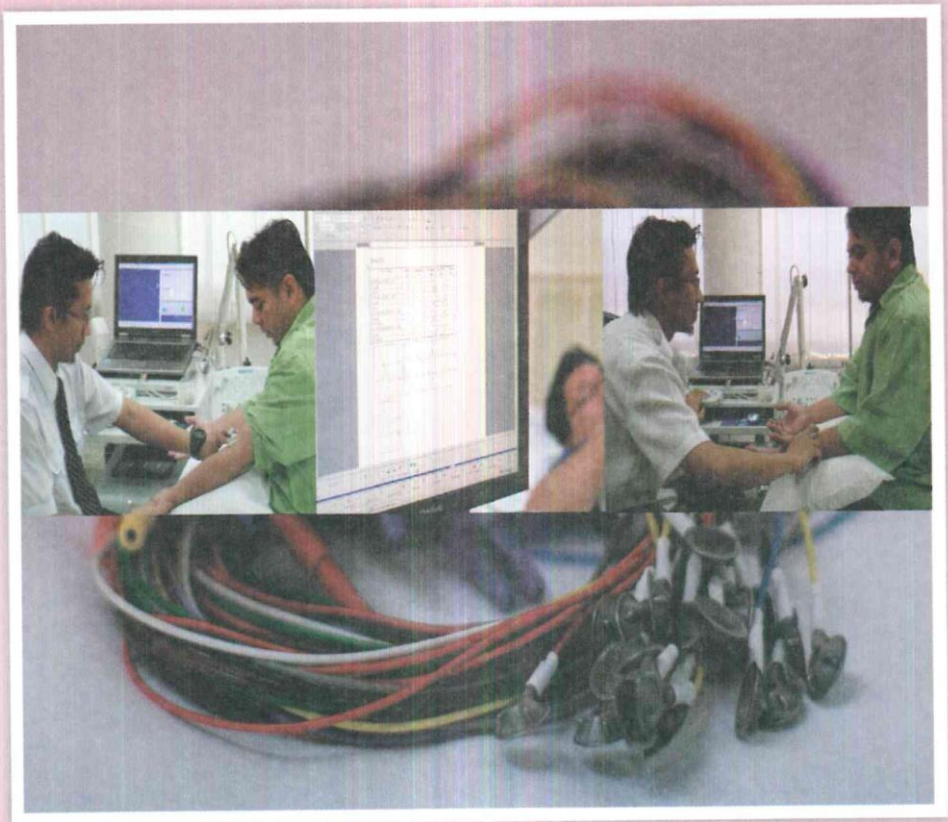
ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
1. Registration	<ol style="list-style-type: none"> <li>1. Receive appointment form</li> <li>2. Confirm patient schedule / appointment</li> <li>3. Register in the standard registration system</li> </ol>	<ol style="list-style-type: none"> <li>1. Name</li> <li>2. I/C number</li> <li>3. R/N</li> <li>4. Age</li> <li>5. Sex</li> <li>6. Race</li> <li>7. Address</li> <li>8. Phone number</li> <li>9. Diagnosis</li> <li>10. Date</li> </ol>	<ol style="list-style-type: none"> <li>1. PSG request form</li> <li>1. Registration book / system</li> </ol>
2. Review Patient's History	<ol style="list-style-type: none"> <li>1. History of sleep disorder</li> <li>2. Family history</li> <li>3. Medical/Surgical history</li> <li>4. Medication</li> <li>5. Previous PSG</li> </ol>	Trace old report (if any exist)	
3. Assessment	<ol style="list-style-type: none"> <li>1. Patient's general appearance &amp; mental status</li> </ol>	<ol style="list-style-type: none"> <li>1. Normal</li> <li>2. Alert</li> <li>3. Uncooperative</li> <li>4. Mentally challenged</li> <li>5. Confused</li> <li>6. Aphasic</li> </ol>	Test to be done under natural / spontaneous sleep
4. Preparation of Patient	<ol style="list-style-type: none"> <li>1. Self - introduction (if applicable)</li> <li>2. Explain the procedure (if applicable)</li> <li>3. Obtain verbal consent (if applicable)</li> <li>4. Position and ensure the patient is comfortable</li> <li>5. Enter patient's demographic data in the system</li> <li>6. Measure, mark and gently degrease site with abrasive prepping gel</li> <li>7. Attach electrodes correctly and securely</li> <li>8. Fix and apply other required sensors</li> </ol>	<p>Introduce yourself to patient/relative (if applicable)</p> <p>With chaperone (if required)</p> <p>10 - 20 International System</p>	<ol style="list-style-type: none"> <li>1. Measuring tape</li> <li>2. Dermatograph pencil</li> <li>3. Skin conditioner</li> <li>4. Gauze / Cotton</li> <li>1. EEG electrodes</li> <li>2. Airflow, Snore, EOG, EMG, (Chin &amp; Leg), Chest, Abdomen and ECG</li> <li>1. Micropore</li> <li>2. Paste</li> </ol>



ACTIVITY	WORK PROCESS	STANDARD		REQUIREMENT	
5. Recording Procedure	1. Perform calibration (mechanical & biological)	1. EEG	HFF 70Hz	LFF 0.5Hz	1. <b>Equipments:</b> PSG machine
		2. EOG	70Hz	0.5Hz	
		3. Chin EMG	100Hz	10Hz	
		4. ECG	70Hz	0.5Hz	
		5. Air Flow	15Hz	0.1Hz	
		6. Snoring	100Hz	10Hz	
		7. Chest	100Hz	25Hz	
		8. Abdomen	100Hz	25Hz	
		9. Leg EMG	100Hz	10Hz	
		10. Oximetry	15Hz	DC	
		11. CPAP Flow	15Hz	0.01-0.03 Hz	
		12. Sensitivity	100 $\mu$ V		
		13. Time base	30 deflection at 100 $\mu$ V sensitivity		
		14. Saturation calibration	<5k $\Omega$ Minimum 6 hours		
	2. Impedance				
	3. Recording				
	4. Annotation of events				
	5. Identify and eliminate or minimize biological and physical artifacts				
	6. Perform calibration (biological & mechanical)	1. EEG	HFF 70Hz	LFF 0.5Hz	
		2. EOG	70Hz	0.5Hz	
		3. Chin EMG	100Hz	10Hz	
		4. ECG	70Hz	0.5Hz	
		5. Air Flow	15Hz	0.1Hz	
		6. Snoring	100Hz	10Hz	
		7. Chest	100Hz	25Hz	
		8. Abdomen	100Hz	25Hz	
		9. Leg EMG	100Hz	10Hz	
		10. Oximetry	15Hz	DC	
		11. CPAP Flow	15Hz	0.01-0.03 Hz	
		12. Sensitivity	100 $\mu$ V		
		13. Time base	30 deflection at 100 $\mu$ V sensitivity		
		14. Saturation calibration			
	7. Remove all electrodes, sensor and paste, gently from patient's scalp and limb				
	8. Clean the electrode				1. Water 2. Sodium Hypochloride 5% (if infectious cases suspected)
6. Reporting	1. Analyze PSG record and scoring 2. Compile PSG record 3. Send PSG record for reporting	AMO  Neurologist			
7. Documentation of report and record	1. Archive PSG record in the system 2. Despatch and file the report	Despatch book			

# FLOW CHART POLYSOMNOGRAPHY (PSG)





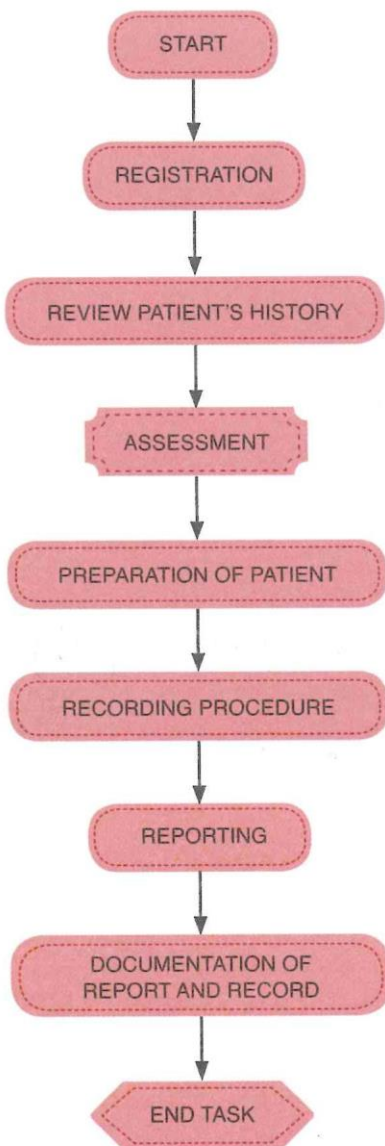
**NERVE CONDUCTION STUDY  
(NCS – CARPAL TUNNEL SYNDROME)**

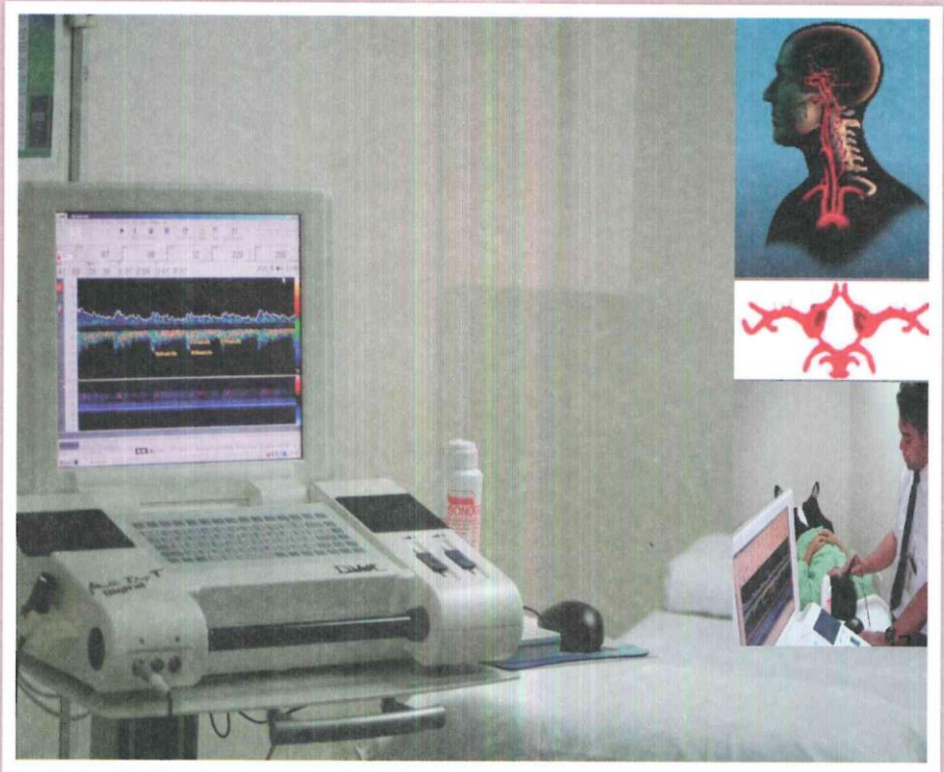
## 7. NERVE CONDUCTION STUDY (NCS) – CARPAL TUNNEL SYNDROME

ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
1. Registration	<ol style="list-style-type: none"> <li>1. Receive appointment form</li> <li>2. Confirm patient schedule / appointment</li> <li>3. Register in the standard registration system</li> </ol>	<ol style="list-style-type: none"> <li>1. Name</li> <li>2. I/C number</li> <li>3. R/N</li> <li>4. Age</li> <li>5. Sex</li> <li>6. Race</li> <li>7. Address</li> <li>8. Phone number</li> <li>9. Diagnosis</li> <li>10. Date</li> </ol>	<ol style="list-style-type: none"> <li>1. Nerve Conduction Study request form</li> <li>1. Registration book / system</li> </ol>
2. Review Patient's History	<ol style="list-style-type: none"> <li>1. Date of onset</li> <li>2. Family history</li> <li>3. Medical/Surgical history</li> <li>4. Medication</li> <li>5. Previous NCS for CTS</li> </ol>	Trace old report (if any exist)	
3. Assessment	<ol style="list-style-type: none"> <li>1. Patient's general appearance</li> </ol>		
4. Preparation of Patient	<ol style="list-style-type: none"> <li>1. Self - introduction</li> <li>2. Explain the procedure</li> <li>3. Obtain verbal consent</li> <li>4. Position and ensure the patient is comfortable</li> <li>5. Enter patient's demographic data in the system</li> <li>6. Measure, mark and gently degrease site with Methylated spirit</li> <li>7. Attach electrodes correctly and securely</li> </ol>	<p>Introduce yourself to patient/relative</p> <p>With chaperone (if required)</p>	<ol style="list-style-type: none"> <li>1. Measuring tape</li> <li>2. Dermatograph pencil / skin marker</li> <li>3. Methylated Spirit</li> <li>4. Gauze / Cotton</li> <li>1. NCS electrodes</li> <li>2. Recording Electrode</li> <li>3. Micropore</li> </ol>

ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
5. Recording Procedure	<ol style="list-style-type: none"> <li>1. Perform calibration</li> <li>3. Start procedures by stimulating the appropriate nerve</li> <li>4. Identify and mark waveform</li> <li>5. Identify and eliminate or minimize biological and physical artifacts</li> <li>6. Measure the distance between distal and proximal stimulation</li> <li>7. Remove all electrodes gently from patient's limb</li> </ol>	<ol style="list-style-type: none"> <li>1. Sensitivity 20 <math>\mu</math>V</li> <li>2. Duration 0.1 m/sec</li> <li>3. Time base 2 m/sec</li> </ol> <p>Motor, F wave and Sensory nerve for both hands</p>	<p><b>Equipments:</b></p> <ol style="list-style-type: none"> <li>1. NCS machine</li> <li>1. Stimulator</li> <li>2. Normal Saline 0.9%</li> </ol> <ol style="list-style-type: none"> <li>1. Measuring tape</li> </ol>
6. Reporting	<ol style="list-style-type: none"> <li>1. Compile NCS record</li> <li>2. Prepare factual report (if required)</li> <li>3. Send NCS record for reporting</li> </ol>	<p>AMO</p> <p>Neurologist</p>	
7. Documentation of report and record	<ol style="list-style-type: none"> <li>1. Archive NCS record in the system</li> <li>2. Despatch and file the report</li> </ol>	<p>Despatch book</p>	

# FLOW CHART NERVE CONDUCTION STUDY (NCS) CARPAL TUNNEL SYNDROME





## **TRANSCRANIAL DOPPLER (TCD)**

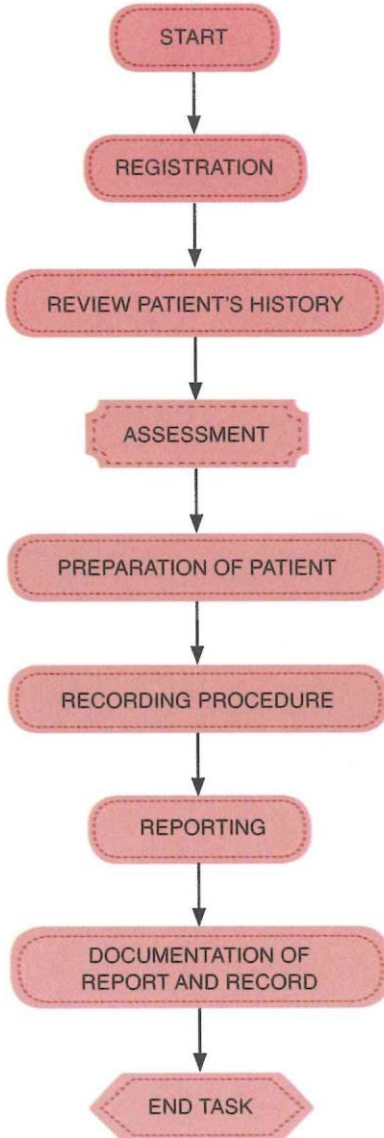
## 8. TRANSCRANIAL DOPPLER (TCD)

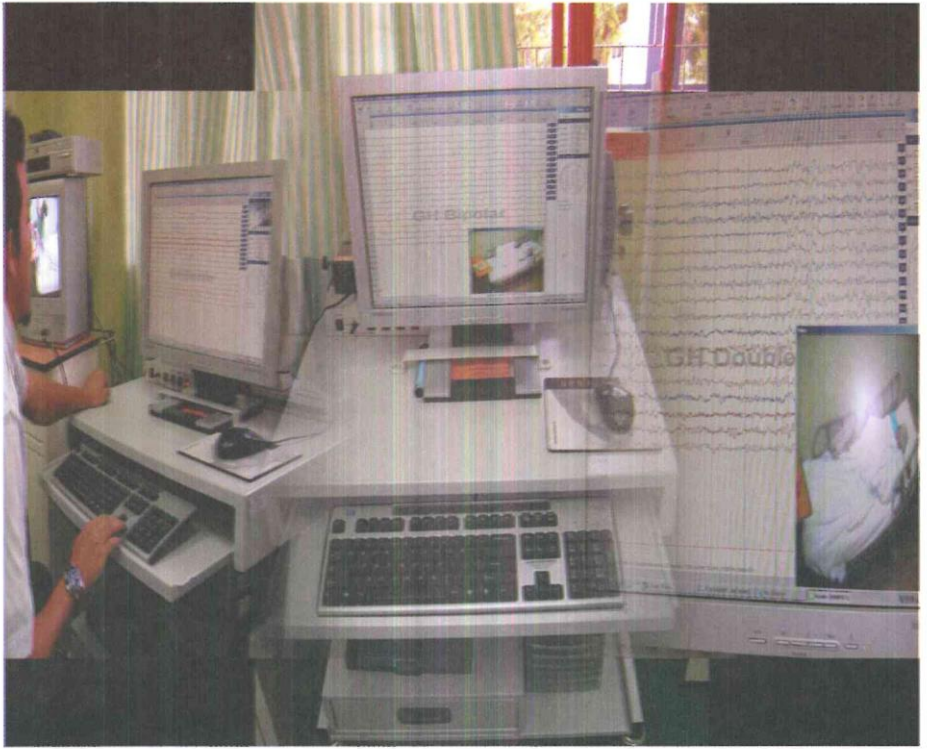
ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
1. Registration	<ol style="list-style-type: none"> <li>1. Receive appointment form</li> <li>2. Confirm patient schedule / appointment</li> <li>3. Register in the standard registration system</li> </ol>	<ol style="list-style-type: none"> <li>1. Name</li> <li>2. I/C number</li> <li>3. R/N</li> <li>4. Age</li> <li>5. Sex</li> <li>6. Race</li> <li>7. Address</li> <li>8. Phone number</li> <li>9. Diagnosis</li> <li>10. Date</li> </ol>	<ol style="list-style-type: none"> <li>1. TCD request form</li> <li>1. Registration book / system</li> </ol>
2. Review Patient's History	<ol style="list-style-type: none"> <li>1. History of Cerebrovascular Accident (CVA) / stroke</li> <li>2. Family history</li> <li>3. Medical/Surgical history</li> <li>4. Medication</li> <li>5. Previous TCD</li> </ol>	Trace old report (if any exist)	
3. Assessment	<ol style="list-style-type: none"> <li>1. Patient's general appearance</li> </ol>		
4. Preparation of Patient	<ol style="list-style-type: none"> <li>1. Self - introduction</li> <li>2. Explain the procedure</li> <li>3. Obtain verbal consent</li> <li>4. Position and ensure the patient is comfortable</li> <li>5. Enter patient's demographic data in the system</li> </ol>	<p>Introduce yourself to patient/relative</p> <p>With chaperone (if required)</p>	



ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
5. Recording Procedure	<ol style="list-style-type: none"> <li>1. Perform calibration</li> <li>2. Choose appropriate probe</li> <li>3. Locate TCD windows</li> <li>4. Identify and eliminate or minimize artifacts</li> <li>5. Wipe gel off from patient after procedure completed</li> </ol>	<ol style="list-style-type: none"> <li>1. Flat baseline</li> <li>2. 2MHz / 4 MHz / 8 MHz</li> <li>1. Middle Cerebral Artery (MCA)</li> <li>2. Posterior Cerebral Artery (PCA)</li> <li>3. Anterior Cerebral Artery (ACA)</li> <li>4. Basilar Artery (BA)</li> <li>5. Vertebral Artery (VA)</li> </ol>	<b>Equipments:</b> <ol style="list-style-type: none"> <li>1. TCD machine</li> <li>2. Conductive gel</li> <li>3. Gauze</li> </ol>
6. Reporting	<ol style="list-style-type: none"> <li>1. Compile TCD record</li> <li>2. Send record for reporting</li> </ol>	AMO Neurologist	
7. Documentation of report and record	<ol style="list-style-type: none"> <li>1. Archive TCD record in the system</li> <li>2. Despatch and file the report</li> </ol>	Despatch book	

# FLOW CHART TRANSCRANIAL DOPPLER (TCD)





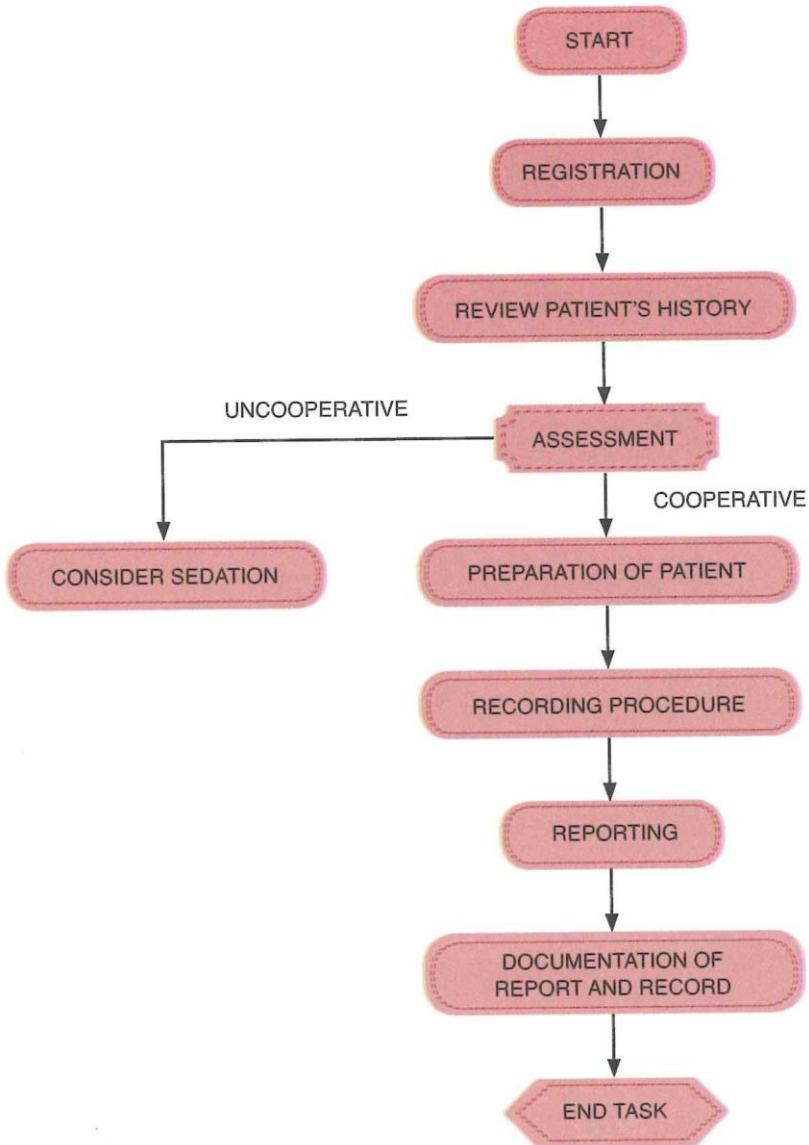
## **VIDEO TELEMETRY RECORDING (VTR)**

## 9. VIDEO TELEMETRY RECORDING (VTR)

ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
1. Registration	<ol style="list-style-type: none"> <li>1. Receive appointment form</li> <li>2. Confirm patient schedule / appointment</li> <li>3. Register in the standard registration system</li> </ol>	<ol style="list-style-type: none"> <li>1. Name</li> <li>2. I/C number</li> <li>3. R/N</li> <li>4. Age</li> <li>5. Sex</li> <li>6. Race</li> <li>7. Address</li> <li>8. Phone number</li> <li>9. Diagnosis</li> <li>10. Date</li> </ol>	<ol style="list-style-type: none"> <li>1. EEG for VTR request card</li> <li>1. Registration book / system</li> </ol>
2. Review Patient's History	<ol style="list-style-type: none"> <li>1. History of Sleep interference</li> <li>2. Last seizure</li> <li>3. Family history</li> <li>4. Medical/Surgical history</li> <li>5. Medication</li> <li>6. Previous VTR</li> </ol>	Trace old report (if any exist)	
3. Assessment	<ol style="list-style-type: none"> <li>1. Patient's general appearance &amp; mental status</li> <li>3. Prepare IV line</li> </ol>	<ol style="list-style-type: none"> <li>1. Normal</li> <li>2. Alert</li> <li>3. Uncooperative</li> <li>4. Mentally challenged</li> <li>5. Confused</li> <li>6. Comatose</li> <li>7. Drowsy /Sleepy</li> <li>8. Sedated</li> <li>9. Aphasic</li> </ol>	<ol style="list-style-type: none"> <li>1. Branula</li> <li>2. Stopper</li> <li>3. Alcohol Swab</li> <li>4. Plaster</li> <li>5. Kidney Dish</li> </ol>
4. Preparation of Patient	<ol style="list-style-type: none"> <li>1. Self- introduction (if applicable)</li> <li>2. Explain the procedure (if applicable)</li> <li>3. Obtain verbal consent (if applicable)</li> <li>4. Position and ensure the patient is comfortable</li> <li>5. Enter patient's demographic data in the system</li> <li>6. Measure, mark and gently degrease site with abrasive prepping gel</li> </ol>	<p>Introduce yourself to patient/relative (if applicable)</p> <p>With chaperon (if required)</p> <p>10 - 20 International System</p>	<ol style="list-style-type: none"> <li>1. Measuring tape</li> <li>2. Dermatograph pencil</li> <li>3. Skin conditioner</li> <li>4. Gauze / Cotton</li> </ol>



# FLOW CHART VIDEO TELEMETRY RECORDING (VTR)





## **ELECTROCEREBRAL INACTIVITY (ECI)**

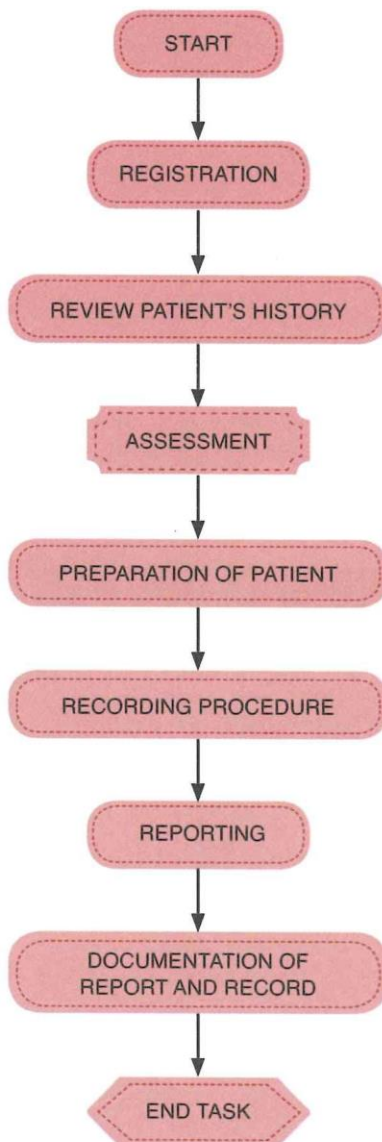
## 10. ELECTROCEBRAL INACTIVITY (ECI)

ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
1. Registration	<ol style="list-style-type: none"> <li>1. Receive appointment form</li> <li>2. Register in the standard registration system</li> </ol>	<ol style="list-style-type: none"> <li>1. Name</li> <li>2. I/C number</li> <li>3. R/N</li> <li>4. Age</li> <li>5. Sex</li> <li>6. Race</li> <li>7. Address</li> <li>8. Phone number</li> <li>9. Diagnosis</li> <li>10. Date</li> </ol>	<ol style="list-style-type: none"> <li>1. EEG request card</li> <li>1. Registration book / system</li> </ol>
2. Review Patient's History	<ol style="list-style-type: none"> <li>1. Date of coma onset</li> <li>2. Medical/Surgical history</li> <li>3. Medication</li> <li>4. Previous EEG</li> </ol>	Trace old report (if any exist)	
3. Assessment	<ol style="list-style-type: none"> <li>1. Patient's general appearance</li> </ol>		
4. Preparation of Patient	<ol style="list-style-type: none"> <li>1. Self - introduction</li> <li>2. Explain the procedure</li> <li>3. Enter patient's demographic data in the system</li> <li>4. Measure, mark and gently degrease site with abrasive prepping gel</li> <li>5. Attach electrodes correctly and securely</li> </ol>	<p>Introduce yourself to patient's relative With chaperone (if required)</p> <p>10 - 20 International System</p>	<ol style="list-style-type: none"> <li>1. Measuring tape</li> <li>2. Dermatograph pencil</li> <li>3. Skin conditioner</li> <li>4. Gauze / Cotton</li> <li>1. EEG electrodes</li> <li>2. Micropore</li> <li>3. Paste</li> </ol>
5. Recording Procedure	<ol style="list-style-type: none"> <li>1. Record patient's body temperature</li> <li>2. Perform calibration (mechanical &amp; biological)</li> </ol>	<ol style="list-style-type: none"> <li>1. Sensitivity 100 <math>\mu V</math></li> <li>2. HFF 70 Hz</li> <li>3. LFF 0.5 Hz</li> <li>4. Time base 30mm/sec</li> <li>5. 10 mm deflection at 100 <math>\mu V</math> sensitivity</li> </ol>	<p><b>Equipments:</b></p> <ol style="list-style-type: none"> <li>1. EEG machine</li> <li>2. Thermometer</li> </ol>



ACTIVITY	WORK PROCESS	STANDARD	REQUIREMENT
	3. Impedance check 4. Activation Procedures  5. Record with appropriate montage  6. Annotation of events 7. Identify and eliminate or minimize biological and physical artifacts 8. Perform calibration (biological & mechanical)  9. Record patient's body temperature 10. Remove all electrodes and paste, gently from patient's scalp 11. Clean the electrodes	< 5k $\Omega$ <b>Stimulation</b> 1. Pinching 2. Clapping 3. Open patient's eyes manually  Bipolar montage minimum 20 minutes with a minimum sensitivity of 2 $\mu$ V/mm  1. Sensitivity 100 $\mu$ V 2. HFF 70 Hz 3. LFF 0.5 Hz 4. Time base 30mm/sec 5. 10 mm deflection at 100 $\mu$ V sensitivity	1. Water 2. Sodium Hypochloride 5% (if infectious cases suspected)
6. Reporting	1. Compile EEG record 2. Prepare factual report (if required) 3. Send EEG record for reporting	AMO  Neurologist	
7. Documentation of report and record	1. Archive EEG record in the system 2. Despatch and file the report	Despatch book	

# FLOW CHART ELECTRO CEREBRAL INACTIVITY (ECI)



# **APPENDIX**

## **NEUROPHYSIOLOGY PROCEDURES STANDARD REQUEST FORM**

**UNIT NEUROFISIOLOGI  
UJIAN EEG**

1. NAMA \_\_\_\_\_ 2. UMUR \_\_\_\_\_ 3. JANTINA \_\_\_\_\_ 4. NO. EEG \_\_\_\_\_

5. TARIKH \_\_\_\_\_ 6. NO. DAFTAR \_\_\_\_\_ 7. NO. K.P \_\_\_\_\_

8. DIAGNOSIS \_\_\_\_\_

9. SEJARAH (PEMBAWAAN, KECEDERAAN KEPALA, UMUR MULA SAWAN, POLA KENERAPAN, TARIKH KEJAZAN SEREBROVASKULAR, KECEDERAAN ATAU PEMBEDAHAN)  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

10. TARIKH INSIDEN TERAKHIR \_\_\_\_\_

11. PENEMUAN KLINIKAL POSITIF (PEMERIKSAAN FISIKAL NEUROLOGI) \_\_\_\_\_

12. PENEMPATAN KLINIKAL \_\_\_\_\_ 13. PENGIRI ATAU PENGANAN \_\_\_\_\_

14. PENGUBATAN \_\_\_\_\_ 15. TARIKH PENGUBATAN DIBERHENTIKAN \_\_\_\_\_

16. TARIKH EEG TERDAHULU \_\_\_\_\_ 17. TUJUAN UJIAN EEG \_\_\_\_\_

18. RANGSANGAN DIBENARKAN \_\_\_\_\_

19. HANTARKAN LAPORAN KEPADA \_\_\_\_\_ 20. WAD \_\_\_\_\_ 21. KLINIK \_\_\_\_\_

22. PAKAR PERUNDING/PAKAR \_\_\_\_\_ 23. TANDATANGAN DAN COP PAKAR \_\_\_\_\_

(SILA PENUHKAN KAD INI DENGAN JELAS)



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KUALA LUMPUR



TEL: 03-26155408

FAX: 03-26155191

---

**EVOKED POTENTIAL (VEP / SSEP / BAEP)  
REQUEST FORM**

---

DATE OF REQUEST:

DATE OF APPOINTMENT:

NAME:

IC NO:

R/N:

WARD / CLINIC:

AGE:

SEX:

ADDRESS:

TEL NO:

RACE:

CLINICAL SUMMARY:

HEIGHT:..... CM

VISUAL ACUITY:..... RIGHT:..... LEFT:.....

HEARING:.....

DIAGNOSIS:

TEST REQUIRED:

PHYSICIAN / SURGEON INCHARGE:

SIGNATURE:

NAME:

---

**REPORT / COMMENT**

---

IMPRESSION:

NEUROLOGIST:

DATE:



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HKL/NEUR/AK-04-03



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**NERVE CONDUCTION STUDY (NCS) & ELECTROMYOGRAPHY (EMG)  
REQUEST FORM**

---

DATE OF REQUEST:

DATE OF APPOINTMENT:

NAME:

IC NO:

R/N:

WARD / CLINIC:

AGE:

SEX:

ADDRESS:

TEL NO:

RACE:

CLINICAL SUMMARY:

MUSCLE WITH FASCICULATION:

DATE OF INJURY:

DIAGNOSIS:

TEST REQUIRED:

PHYSICIAN / SURGEON INCHARGE:

SIGNATURE:  
NAME:



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HKL/NEUR/AK-04-04



**TRANSCRANIAL DOPPLER (TCD)  
 REQUEST FORM**

DATE OF REQUEST:

DATE OF APPOINTMENT:

NAME:

IC NO:

R/N:

WARD / CLINIC

AGE:

SEX:

ADDRESS:

TEL NO:

RACE:

CLINICAL FINDINGS:

SIGNATURE:

NAME:

**TCD REPORT**

FINDINGS:

RIGHT		MCA	LEFT	
DEPTH (mm)	MV (cm/s)		DEPTH (mm)	MV (cm/s)
		ACA		
		PCA		
		VERTEBRAL		

BASILAR	
DEPTH (mm)	MV (cm/s)

TCD WINDOW:

TCD DONE BY:

FINDINGS AND CONCLUSION:

REPORT BY:

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