

## ROLE OF PRE-OPERATIVE SSEP AS POST OPERATIVE OUTCOME INDICATOR IN INTRADURAL EXTRAMEDULLARY SPINE TUMOUR PATIENTS

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Received : 09/10/2022  
Received in revised form : 20/11/2022  
Accepted : 03/12/2022

Keywords:  
IDEM, SSEP, Frankel's grade, Post operative outcome.

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DOI: 10.47009/jamp.2022.4.5.179

Source of Support: Nil,  
Conflict of Interest: None declared

Int J Acad Med Pharm  
2022; 4 (5); 859-862



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### Abstract

**Background:** Intradural extramedullary tumours are usually benign tumours and commonly presents as a cause of neurological deficit as per the level of presentation of tumours. Being benign in nature a usual good outcome is expected in patients of intradural extramedullary (IDEM) tumours after surgery. Many factors have been studied to predict the outcome indicators for intradural extramedullary tumours after surgery and with advances in objective electrophysiological monitoring, it seems that we can objectively define the prognosis of intradural extramedullary tumour patients in preoperative period only. **Materials and Methods:** A prospective analytical study done under our Department of Neurosurgery at our institute from March 2018 to October 2020 after clearance from institute ethical committee. Consecutive patients admitting with diagnosis of intradural extramedullary were included in study with exclusion of patients who have recurrent lesions and with coexisting peripheral neuropathy. Patients were evaluated clinically and were graded as per their functional status in terms of functional frankel's grade of the patient. We objectively studied the latency of somatosensory evoked potential (SSEP) waveform to appear after stimulation in preoperative assessment for defining the damage to neuronal tissue due to tumour at the time of presentation in pre operative phase. **Result:** In our study out of total 160 patients, 60 patients noted improvement in terms of functional frankel's grade and out of these 60 patients 44 patients did not have prolonged SSEP in pre operative period and those 100 patients who did not have an improvement in frankel's grade 76 patients had prolonged SSEP. **Conclusion:** SSEP has an established role in preventing intraoperative injury to nerve roots during surgery for IDEM tumours. In this study, it is concluded that pre operative SSEP can be used as a tool for objectively predicting outcome after surgery in IDEM patients. The latency in SSEP waveform to appear directly correlates with duration of symptoms and inversely with good outcome following surgery.

## INTRODUCTION

Spinal tumour is an important inclusion in the complete differential diagnosis for any patient presenting with weakness in limbs, pain in limbs, radicular symptoms, neck pain and back pain.<sup>[1,2]</sup>

According to the anatomical location, spinal tumours are conventionally classified as extradural and intradural, though some tumours could be both inside and outside the dura. Intradural tumours could be intramedullary or extramedullary. Benign

and malignant neoplasms may arise from intraspinal structures like the meninges, spinal cord, nerve roots, blood vessels and other tissues.<sup>[3]</sup> Schwannomas and neurofibromas lie either within the spinal canal or "dumbbell" through the intervertebral foramen, on occasions presenting as a mass in the thorax or posterior abdominal wall.<sup>[4]</sup> Intradural spinal tumours account for only small proportion of CNS tumours with an incidence of 0.3 per 100,000 per year.<sup>[5]</sup> Two third of intradural tumours are extramedullary.<sup>[6]</sup> Patient with spinal

lesions usually present with any of the three main symptoms: pain both local and radicular, motor disturbances like limb weakness and spasticity and sensory disturbances.<sup>[7]</sup>

Plain X-ray and MRI are the usual imaging modalities used to evaluate patients with spinal lesions. The later offers the advantage of being noninvasive and sensitive in detection of the most lesions.

Outcome of spinal cord tumors is measured in terms of motor function, sensory function, and development of spinal deformity. Outcome is dependent on a number of factors including clinical factors, radiological factors, histological characteristics of tumor, surgery related factors and functional factors.

Outcome predictors after surgery of these tumours which usually have been described already in literature include age of the patients, duration of symptoms, pre-operative functional status, histology, size of tumours, severity of cord compression, tumour cord relationship, extent of tumour removal, per operative and also post-operative complications.<sup>[8]</sup>

The somatosensory-evoked potential (SEP) is the response to electrical stimulation of peripheral nerves. Stimulation of almost any nerve is possible, although the most commonly studied nerves are: a) Median b) Ulnar c) Peroneal d) Tibial. The recording is made from various levels of the nervous system, including afferent nerve volley, spinal cord and brain. The most commonly chosen nerves are median nerve for upper limb and tibial for lower limb.

An increase in latencies greater than 10% and a decrease in amplitudes greater than 50% constitute a significant finding. SSEP has been an established tool in preventing intraoperative neural injury in spine surgeries specially intramedullary tumours but in resource constrained settings its role as a pre operative tool to predict post operative outcome in intradural extramedullary tumour has not been studied extensively yet.

We carried out this study to assess the relevance of pre operative SSEP in predicting post operative outcome in intradural extramedullary spinal tumour patients.

## MATERIALS AND METHODS

It was a prospective comparative study carried out in our department of neurosurgery at our institute. The period of study was from March 2018 to October 2020. The study population recruited were the patients coming to neurosurgery OPD over the study period. All consecutive cases with intradural extramedullary location of tumour who were fit for surgery were included in this study and the patients with recurrent tumours and those with coexisting peripheral neuropathy were excluded out of the study. Total number of patients recruited in the

study were 160. All the patients recruited in the study were evaluated clinically with presenting complaints, duration of symptoms, functional motor status in terms of Frankel's grade of patients and radiologically with contrast MRI and CT if necessary. All patients were subjected to evaluation of somatosensory evoked potential waveform and latency in waveform to appear were evaluated. Patients were briefed about the nature and severity of their illness and informed consent was taken for surgery with associated all risks and benefits been explained well to patients. Data were collected for demographic profile of the patient, clinical status of patient in pre operative period, recovery of patient in post operative period in terms improvement in functional motor status in terms of frankel's grade of patients at follow up period of post-surgery at week 6 and 6 months. The outcome variable for analysis chosen was the frankel's functional grade of patients and any change in the same if any. All patients underwent gross total resection of tumour via posterior approach. Patients were discharged on post operative day 10 after suture removal except for patients who experienced wound infection who were managed conservatively with dressing and antibiotics. All the data collected and recorded were subjected to statistical evaluation using Statistical Product and Service Solutions (SPSS) 17 software (SPSS Inc, USA) was used for the statistical analyses and relevant statistical tests were applied for assessment of results.

Informed written consent was taken from all the study subjects. No pressure coercion was executed on subjects for participation in the study. Confidentiality and privacy were ensured at all levels. The subject was free to leave the study at any time but no lost to follow up recorded in the study.

## RESULTS

Total of 160 patients were recruited in the study with age ranging from 19 to 68 years with mean age 38 years. Out of 160 patients, 92 were females and 68 were males with following distribution of IDEM tumours at various spinal levels. [Table 1]

The SSEP were recorded and latency in mean duration for appearance of SSEP wave was noted and increase in more than 10% was considered significant for labelling as prolonged SSEP. The mean duration of symptoms was also noted and assessed at various levels of tumour location. [Table 2]

Relation with duration of symptoms with latency values in SSEP waveform was compared and analysed which demonstrated that tumours with longer duration of symptoms had longer latencies for SSEP waveform to appear which was statistically significant also. [Table 3]

The pre operative functional status of patients with tumours at various levels in terms of frankel's grade was evaluated and compared with post operative

Frankel's grade and assessed for change if any. [Table 4]  
 The Frankel's grading of patients as an outcome indicator was recorded at post op week 6 and at 6 months respectively. [Table 5]

Improvement in Frankel's grading and hence functional status of patient was compared with pre op increased latencies of SSEP waveform to appear. [Table 7]

**Table 1: Distribution of spinal levels of IDEM tumours in study population**

Location of tumour in spine	n (number of patients)
Cervical	16/160 (10.0%)
Lumbar	32/160 (20.0%)
Thoracic	72/160 (45.0%)
Thoracolumbar	40/160 (25.0%)

**Table 2: Variation in SSEP latencies at various levels of tumour location and mean duration of symptoms at various levels (P value not significant)**

	SSEP prolonged	Not prolonged	SSEP Prolonged (Delay of > 10% in SSEP waveform latency to appear)	Duration in months (Mean)	
Cervical	04 (25%)		12 (75%)	9.6 (3.2)	P value (SSEP variation) 0.46; P value (Variation in mean duration) 0.924
Thoracic	24 (33%)		48 (66%)	8.7 (2.7)	
Thoracolumbar	24 (60%)		16 (40%)	8.8 (3.7)	
Lumbar	16 (50%)		16 (50%)	9.7 (3.0)	

**Table 3: Prolonged latencies of SSEP waveform with mean duration of symptoms (P value significant)**

	<6 Months	>6 Months	Total	
SSEP Not Prolonged	20	48	68	P value: 0.028
SSEP Prolonged	04	88	92	
Total	24	136	160	

**Table 4: Preop functional status of patients with tumours at various levels**

Frankel's grade Level	A	B	C	D	E
Cervical	00	08	04	04	00
Dorsal	00	04	24	44	00
Dorso lumbar	00	08	16	16	00
Lumbar	00	04	12	16	00
Total	00	24	56	80	00

**Table 5: Frankel's grade of patients at post op week 6**

Frankel's grade Level	A	B	C	D	E
Cervical	00	08	00	08	00
Dorsal	00	04	08	36	20
Dorso lumbar	00	08	12	16	08
Lumbar	00	04	08	16	04
Total	00	24	28	76	32

**Table 6: Frankel's grade of patients at post op 6 Months**

Frankel's grade Level	A	B	C	D	E
Cervical	00	04	04	04	04
Dorsal	00	00	04	40	28
Dorso lumbar	00	04	08	20	08
Lumbar	00	04	04	16	08
Total	00	12	20	80	48

**Table 7: Improvement in Frankel's grade of patients compared with prolonged latencies in SSEP waveform to appear suggestive of better improvement with no prolongation in SSEP waveform latencies with p value of 0.02 (significant)**

	SSEP not prolonged	SSEP prolonged	Total	
Improvement in Frankel's grade	44	16	60	P value 0.02 Chi square statistics : 9.34
No improvement in Frankel's grade	24	76	100	

## DISCUSSION

The patients who noted an improvement were those who were having good pre operative Frankel's grade on presentation as compared to those who were having poor grades noted either no or later improvement.

In our study we looked for latency of somatosensory evoked potential in pre operative period after the admission of patients. The prolongation in SSEP latency more than 10% considered significant,<sup>[8-13]</sup> and was found to be corroborating with mean duration of symptoms. Patients with earlier presentation of less than 6 months had low incidence of prolongation of latency to peak (4/24;

16.66%) as compared to those presenting with more than 6 months of duration (88/136; 64.70%). Changes in SSEP latency values were independent of location of tumour on MRI.

The prolonged latencies in SSEP waveform to appear were directly related to longer duration of symptoms and it was significant statistically. SSEP latencies can be objective evidence of longer duration of symptoms affecting the outcome in intradural extramedullary tumour patients negatively.

No other previous study has compared pre op SSEP latencies with post operative outcome in IDEM patients. As has been evidenced mean duration symptoms also corroborated directly with prolongation of SSEP latencies and hence impact outcome negatively has been studied previously also as in Mondal et al,<sup>[1]</sup> Govind et al,<sup>[9]</sup> Ahn et al,<sup>[10]</sup> and Shekhar et al.<sup>[11]</sup> Our finding corroborates with theirs with respect to mean duration of symptoms.

As we had no previous study in literature to compare it has been a limitation for our study also, other limitations being small sample size.

## CONCLUSION

The most important predictor of favourable outcome in IDEM tumour patients after surgical intervention is their functional status in terms of Frankel's grading in pre op period. Those having similar Frankel's grading status but subtle differences in their nerve conduction properties as observed with SSEP latencies have impact on their functional outcome directly relating to changes in their SSEP waveform latencies. Patients with no changes in SSEP waveform latencies have a better outcome and earlier improvement as compared to those having an increased latency. Increased latencies in SSEP despite similar functional status is a direct correlate of duration of symptoms. Increased pre operative SSEP waveform latencies to appear can also be reliable objective evidence of duration of symptoms. SSEP studies can be a good predictor of outcome in good Frankel's grading patients who presents earlier in their course of disease where overt neurological

deterioration have not occurred in advanced stages incapacitating patient's functional performance.

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