



# Monitoring of Motor Evoked Potentials During Aneurysm Surgery: Efficacy and Comparison to Somatosensory Evoked Potentials

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## Introduction

Post operative motor deficit is a major concern after aneurysm surgery. Neurophysiological monitoring may provide more safety during the procedure. However the differences between monitoring SSEP and MEP are not known in contributing to the patient outcome.

## Objectives:

To examine the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of MEP and SSEP.

The primary outcomes were changes in MEP and/or SSEP monitoring during surgery and post-operative motor deficit (weakness).

The secondary outcomes were 72-hour post-operative CT results, length of stay (LOS), and modified Rankin Scale (mRS) at discharge or death.

## Methods

Retrospective chart review of all cerebral aneurysms surgically treated between 2010-2014 at two institutions was done. Cases that are not monitored are excluded from the final analysis. Basic demographic were collected.

In order to calculate sensitivity and specificity we made the following definitions:

- True positive  
IONM changes temporally related to a surgical event OR  
IONM changes with a new post-operative motor deficit that correlates with the changes
- True negative  
No IONM changes and no new post-operative motor deficit

- False positive  
IONM changes unrelated to a surgical event and no new post-operative motor deficit

- False negative  
No IONM changes and new post-operative motor deficit  
A greater than 50% decrease in the amplitude of each modality was considered alarming and was communicated to the surgeon.

72-hour post-operative CT results were defined as no infarction, infarction related to surgery and infarction unrelated to surgery.

## Results

259 patients were identified, 239 were included in the final analysis (20 excluded). The mean age was  $54.91 \pm 12.55$  years. The majority of subjects were female (72.80%). 119 patients (49.79%) present with SAH. only 4 cases required bypass.

36 (15.06%) received SSEP alone and 203 (84.94%) received SSEP and MEP together. Age, gender, presence of SAH and the grade of SAH were not statistically different between the two groups. Sensitivity, specificity, PPV and NPV were reported separately for MEP and SSEP and reported (Table-1). Both tests were very specific, but not very sensitive. However, MEP tend to be more sensitive than SSEP (68.75% vs. 62.5%)

There was no significant association between monitoring type and post-operative deficit,  $P < 1.0000$ , (Table-2). There were a total of 14 (5.86%) new post-operative motor deficits; 2 (5.56%) SSEP and 12 (5.91%) SSEP + MEP.

There was no significant association between monitoring and 72-hour post-operative CT results ( $P < 0.4836$ ). There were a total of 32 (13.97%) infarctions related to surgery; 4 (11.76%) SSEP and 28 (14.36%) SSEP + MEP. The majority of subjects had no infarction (81.22%); and 4.80% had infarctions unrelated to surgery (8.82% SSEP and 4.10% SSEP + MEP).

There was no significant association between monitoring and length of stay (LOS) ( $P < 0.7358$ ). The median LOS was 9.00 days in the SSEP group, and for SSEP + MEP group was 12.00 days. There was no significant association between monitoring and mRS,  $P < 0.7242$ , (Fig-1).

There was no significant association between temporary clip and post-operative deficit ( $P < 0.7753$ ), 72-hour post-operative CT results ( $P < 0.0989$ ) or mRS ( $P < 0.4509$ ). There was a significant association between temporary clip and LOS ( $P < 0.0014$ ). The median LOS for those with temporary clip was 14.00 days, where as for those without a temporary clip was 4.00 days.

## Conclusions

Although statistically, there was no difference between post operative deficit in SSEP group and SSEP+MEP group, both test have very high negative predictive value, meaning, that when they are negative it is unlikely to have post operative deficit. MEP tend to have higher positive predictive value, meaning when positive, there is a higher chance of post operative deficit.

MEP and SSEP were not statistically different in regard to LOS and on discharge mRS. Temporary clipping was associated with longer LOS. We believe this was related to the fact most of those patient harbored more complex aneurysms.

table-1

	SSEP (95% CI)	MEP (95% CI)
Sensitivity	62.50 (35.43, 84.80)	68.75 (41.34, 88.98)
Specificity	98.65 (96.10, 99.72)	98.92 (96.17, 99.87)
PPV	76.92 (46.19, 94.96)	84.62 (54.55, 98.08)
NPV	97.33 (94.29, 99.02)	97.35 (93.93, 99.14)

table-2

Neurologic deficit and monitoring modality

MEP(MEP)			
Frequency	No	Yes	Total
Percent			
Row Percent			
Col Percent			
SSEP	34	2	36
	14.23	0.84	15.06
	94.44	5.56	
	15.11	14.29	
SSEP + MEP	191	12	203
	79.92	5.02	84.94
	94.09	5.91	
	84.89	85.71	
Total	225	14	239
	94.14	5.86	100.00

Fig-1

