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Reversible Change in Somatosensory Evoked Potential – Looks trustworthy!!!

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ABSTRACT:

Temporary clip placement on parent vessel is a commonly used technique in cerebrovascular surgery to facilitate clipping of intracranial aneurysms. However, it increases the risk of decreased distal cerebral perfusion. Therefore, prolonged clip time can lead to new onset stroke. Somatosensory evoked potentials (SSEPs) can be used during aneurysm clipping to detect changes in cerebral blood flow with surgical manipulation. Evidence has shown that irreversible SSEP loss and delayed restoration of blood flow after SSEP loss leads to postoperative neurologic deficits. In this case report, we present a case of subarachnoid haemorrhage due to right middle cerebral artery aneurysm presenting for clipping, where patient developed significant loss of SSEP intraoperatively in spite of burst suppression due to prolonged TC time. However, early removal of clip and restoration of blood flow reverted the SSEP changes and prevented stroke. Although, SSEP monitoring alone can have its own limitations, we would still emphasize on its importance through this case.

Key words: Somatosensory evoked potentials; aneurysm clipping; stroke; temporary clip

Introduction

Temporary clipping (TC) is a valuable technique commonly employed during microsurgical clipping of intracranial aneurysms as it facilitates handling of the aneurysm and prevents its rupture. However, TC is associated with distal cerebral ischaemia and consequent postoperative neurologic deficits. Somatosensory evoked potentials (SSEP) monitoring can be used during TC to detect decreases in cerebral blood flow (CBF) and prevent stroke. Loss of SSEP waveform has been found to be associated with increased risk of stroke. In this case report, we present a patient in whom SSEP monitoring provided a warning and a potential stroke was prevented.

Case report

A 32-year-old male, chronic smoker, presented with history of sudden onset headache with multiple episodes of vomiting 25 days back. There was no history of seizures or prior co-morbidities. On examination, the patient was conscious, following commands and had no motor or sensory deficits. Computed tomogram showed subarachnoid hemorrhage (SAH) in the right sylvian fissure. Magnetic resonance angiogram showed bilobed aneurysm in the right middle cerebral artery (MCA), directed superolaterally with vasospasm in the right MCA. The patient was started on mannitol 20% and phenytoin. Clipping of aneurysm through right pterional craniotomy was planned. Anaesthesia was induced with fentanyl, propofol and

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vecuronium and maintained with isoflurane < 0.5 MAC and propofol infusion at 4mg/kg/hour. In addition to routine monitoring, neuromonitoring was accomplished using electroencephalography (EEG) and SSEP using median and posterior tibial nerve stimulation for bilateral upper and lower limbs respectively. SSEP recording electrodes were placed using the International 10-20 System at points FZ, CZ, C3, and C4. Monitoring was done every 10 min during non-critical periods of surgery and continuous monitoring was planned during temporary and permanent clipping. The recordings were visually analyzed for the presence of the main peaks N20–P25 and P40–N50, and peak to peak amplitudes as well as peak latencies were measured. Intraoperatively, aneurysm ruptured. Before TC application on distal right internal carotid artery (ICA), burst suppression was achieved using propofol bolus of 1.5 mg/kg and infusion rate of 8 mg/kg/hour. A temporary drop in blood pressure was managed with 3mg mephentermine bolus. Bilateral SSEPs in lower and upper limb were intact after 8 min of TC on ICA. Thereafter, the clip was placed on proximal MCA for 5 min. It was then repositioned to distal MCA for 6 min. Following 19 min of total TC time, the SSEP amplitude on right cortex (C4-Fz) from left upper limb stimulation decreased to less than 50% of baseline (Fig 1A). The SSEPs of the contralateral side and of lower limbs were intact and haemodynamics were well maintained. The surgeon was informed about the change in SSEP. He placed the permanent clip on the aneurysm 5 min later and TC was removed after a total of 24 min. After 5 min of reperfusion, the SSEPs returned to the baseline (Fig 1B). Hence, overall SSEP change persisted for 10 min. Continuous monitoring of evoked potentials was continued. The propofol infusion was decreased to keep EEG out of burst suppression and balanced anesthesia was continued. After reversal from anesthesia, the patient was conscious with no neurological deficits.

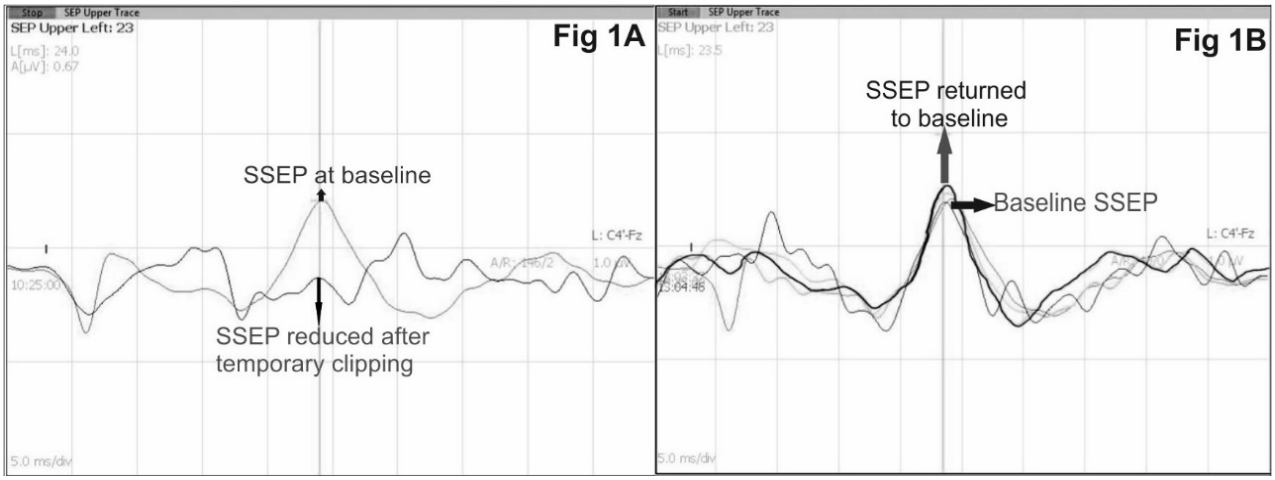

Figure 1A: Somatosensory Evoked Potentials (SSEP) recorded from left upper limb stimulation reduced in amplitude when compared to baseline after temporary clipping time of 19 minutes.

Figure 1B: Somatosensory Evoked Potentials returned back to baseline after reperfusion for 5 minutes.

Discussion

TC is frequently used in intracranial aneurysm surgery to create focal hypotension before placement of permanent clip. TC is associated with risk of cerebral ischaemia and postoperative neurological sequalae in the corresponding vascular territory. The incidence of symptomatic strokes in patients undergoing clipping of cerebral aneurysms ranges from 10% to 12%. [1] SSEP monitoring can serve as a surrogate measure for cerebral perfusion. CBF is approximately 50 mL/100 g/min at baseline, but decrease in CBF to 14 mL/100 g/min results in an approximately 50% reduction in SSEP amplitude. [2] Intraoperative neurophysiologic monitoring

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(IONM) with SSEP can detect decrease in cerebral blood flow due to TC, allowing the surgeon time for intraoperative adjustments which can result in reversal of SSEP changes and prevent postoperative sequelae. We alerted the surgeon about dampening of SSEP waveform and within the next 5 min the permanent clip was placed and TC removed.

In a retrospective study of 437 patients to determine the predictors of perioperative stroke in relation to surgical aneurysm clipping, it was found that patients with higher severity of clinical grade of SAH (Hunt and Hess) and those with intraoperative SSEP changes were about 7 times more likely to develop perioperative stroke than those without. Also, aneurysm rupture alone was not predictive of the perioperative stroke rate. [3]

In another study, it was found that intraoperative SSEP changes and increased single episode TC duration are independently associated with increased perioperative stroke risk. SSEP changes are most predictive for perioperative stroke in unruptured cases. [4] A 60 minute cut off has been described by Staarmann et al to describe a change in SSEP as temporary or permanent. [5] However, Samson et al have described a threshold of 15-20 min whereby iatrogenic ischaemia is converted to infarct. [6] To describe the safe duration of TC, Kang et al have described Ischemic tolerance ratio which is the ratio of time between onset of IONM change and blood flow resumed to time from TC application to IONM change. [7] This ratio if maintained < 50%, decreases postoperative neurologic deficits whereas >80% predicts the occurrence. In this patient, it was 26%. This patient had cerebral ischaemia probably due to prolonged TC time and also rupture of aneurysm might have contributed to transient cerebral ischemia. It is still not known how long SSEP changes should persist to cause irreversible neurologic deficits. Byuon et al, found that age ≥ 62.5 years, history of stroke, and inversely, use of intraoperative SSEP monitoring are independent risk factors for ischaemia and all these factors turned favourable for this patient. [8]

Our patient had an initial decline in the SSEP waveform which reversed intraoperatively. This is a classic example of true negative as patient woke up without any deficit. [5] However, Weidemayer et al, classify such case as true positive as it is a correct prediction of impending neurological deficit. [9]

MEP monitoring combined with SSEP enhances its sensitivity. Nevertheless, SSEP monitoring is less affected by anaesthetics, can be performed continuously and has high specificity which makes it an effective and feasible monitoring tool for preventing intraoperative hypoperfusion. SSEP monitoring has been shown to have very good predictive ability for postprocedural neurological deficits in patients undergoing endovascular treatment of cerebral aneurysms. [10]

Conclusion

Information from SSEP monitoring can be used to prevent impending stroke during cerebrovascular surgery for aneurysm clipping.

References

1. Lavine SD, Masri LS, Levy ML, Giannotta SL. Temporary occlusion of the middle cerebral artery in intracranial aneurysm surgery: time limitation and advantage of brain protection. J Neurosurg 1997;87:817-824.
2. Symon L. The relationship between CBF, evoked potentials and the clinical features in cerebral ischaemia. Acta Neurol Scand Suppl 1980;78;175-190.
3. Kashkoush AI, Jankowitz BT, Nguyen C, Gardner PA, Wecht DA, Friedlander RM et al. Perioperative stroke after cerebral aneurysm clipping: Risk factors and postoperative impact. J Clin Neurosci 2017;44:188-195.
4. Kashkoush AI, Jankowitz BT, Gardner P, Friedlander RM, Chang YF, Crammond DJ et al. Somatosensory Evoked Potentials During Temporary Arterial Occlusion for Intracranial Aneurysm Surgery: Predictive Value for Perioperative Stroke. World Neurosurg 2017;104:442-451.

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5. Staarmann B, Neal KO, Magner, M, Zuccarello M. Sensitivity and Specificity of Intraoperative Neuromonitoring for Identifying Safety and Duration of Temporary Aneurysm Clipping Based on Vascular Territory, a Multimodal Strategy. World Neurosurgery 2017;100:522-530.
6. Samson D, Batjer H, Bowman G, Mootz L, Krippner WJ Jr, Meyer YJ, Allen BC. A clinical study of the parameters and effects of temporary arterial occlusion in the management of intracranial aneurysms. Neurosurgery 1994;34:22-29.
7. Kang D, Yao P, Wu Z, Yu L. Ischemia changes and tolerance ratio of evoked potential monitoring in intracranial aneurysm surgery. Clin Neurol Neurosurg 2012;115:552-556.
8. Byoun HS, Bang JS, Oh CW, Kwon O-Ki , Hwang G , Han JH et al. The incidence of and risk factors for ischemic complications after microsurgical clipping of unruptured middle cerebral artery aneurysms and the efficacy of intraoperative monitoring of somatosensory evoked potentials: A retrospective study. Clinical Neurology and Neurosurgery 2016;151:128-135.
9. Wiedemayer H, Sandalcioglu IE, Armbruster W, Regel J, Schaefer H, Stolke D. False negative findings in intraoperative SEP monitoring: analysis of 658 consecutive neurosurgical cases and review of published reports. J Neurol Neurosurg Psychiatry 2004;75:280-286.
10. Ares WJ, Grandhi RM, Panczykowski DM, Weiner GM, Thirumala P, Habeych ME et al. Diagnostic Accuracy of Somatosensory Evoked Potential Monitoring in Evaluating Neurological Complications During Endovascular Aneurysm Treatment. Oper Neurosurg (Hagerstown) 2018;14(2):151-157.

Conflict of Interest and Source of Funding statement

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