Intraoperative Visual Evoked Potential Monitoring

Visual evoked potential (VEP) is recorded from the back of the head, which is elicited by retinal stimulation transmitted through optic nerve, optic chiasm, optic tract, Lateral geniculate nucleus, optic radiation and finally primary visual cortex.

VEP monitoring did not prevail since 1990s because marked intra-individual difference and instability of VEP recording limited the clinical usefulness under inhalation anesthetic management and techniques of VEP monitoring at the time. However, recent advances in techniques including a new light-stimulating device consisting of high-luminosity LEDs and induction of electroretinography to ascertain the arrival of the stimulus at the retina provided better conditions for stable VEP recording under general anesthesia. In addition, the introduction of total intravenous anesthesia using propofol is important for the successful VEP recordings because inhaled anesthetics have suppressive effect on VEP waveform. Intraoperative VEP has been considered to monitor the functional integrity of visual function during neurosurgical procedures, in which the optic pathway is at a risk of injury. Intraoperative VEP monitoring may allow us to detect reversible damage to the visual pathway intraoperatively and enable us to prevent permanent impairment [1)].

During surgeries that put the visual pathway at risk of injury, continuous monitoring of the visual function is desirable. However, the intraoperative monitoring of the visual evoked potential (VEP) is not yet widely used.

Satisfactory intraoperative VEP monitoring was feasible in all patients except in those with severe visual impairment. Preservation of VEPs predicted preserved visual function. During resection of lesions in the visual cortex, VEP monitoring could not detect new major visual field defects due to injury in the posterior visual pathway. Intraoperative VEPs were sensitive enough to detect vascular damage during aneurysm clipping and mechanical manipulation of the anterior visual pathway in an early reversible stage. Intraoperative VEP monitoring influenced surgical decisions in selected patients and proved to be a useful supplement to the toolbox of intraoperative neurophysiological monitoring [2)].

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Case series

In 46 consecutive surgeries in 2011-2013. High luminance stimulating devices delivered flash stimuli on the closed eyelid during intravenous anesthesia. We monitored VEP features N75 and P100 and took patients' preoperative and postoperative visual function from patient charts. Postoperative ophthalmologic workup was performed in 25 (54%) patients and preoperatively in 28 (61%) patients.

VEP recordings were feasible in 62 of 85 eyes (73%) in 46 patients. All 23 eyes without VEP had impaired vision. During surgery, VEPs remained stable throughout surgery in 50 eyes. In 44 of these, visual function did not deteriorate and three patients (6 eyes) developed hemianopia. VEP decreased transiently in 10 eyes and visual function of all was preserved. VEPs were lost permanently in 2 eyes in two patients without new postoperative visual impairment.

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1)

Hayashi H, Kawaguchi M. [Intraoperative Visual Evoked Potential Monitoring]. Masui. 2015 May;64(5):508-14. Japanese. PubMed PMID: 26422958.

2)

Luo Y, Regli L, Bozinov O, Sarnthein J. Clinical utility and limitations of intraoperative monitoring of visual evoked potentials. PLoS One. 2015 Mar 24;10(3):e0120525. doi: 10.1371/journal.pone.0120525. eCollection 2015. Erratum in: PLoS One. 2015;10(7):e0133819. Dosage error in article text. PubMed PMID: 25803287; PubMed Central PMCID: PMC4372588.

3)

Luo Y, Regli L, Bozinov O, Sarnthein J. Clinical Utility and Limitations of Intraoperative Monitoring of Visual Evoked Potentials. PLoS One. 2015 Mar 24;10(3):e0120525. doi: 10.1371/journal.pone.0120525. eCollection 2015. PubMed PMID: 25803287.