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Falsely nonrecordable flash visual evoked cortical potentials in a diabetic eye with severe vitreous hemorrhage

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Abstract The examination of visual evoked cortical potentials (VECPs) prior to vitrectomy has been proposed for selection of patients with good chances for a favorable outcome following surgery. A missing single flash VECP has been considered a contraindication for further surgical treatment. A 64-year-old woman with proliferative diabetic retinopathy suffered from an intensive vitreous hemorrhage in one eye. Preoperatively, the flash VECP was nonrecordable. Intraoperatively, a dense vitreous hemorrhage and retrohyaloidal blood was found. The retina was attached. Postoperatively, the flash VECP was similar in both eyes with normal latencies. The visual acuity improved from light perception to 0.05. Severe vitreous hemorrhage may interfere with preoperative VECP recordings. A nonrecordable VECP has to be judged cautiously so as to prevent false-negative responses in eyes that could regain vision following vitrectomy and removal of the hemorrhage.

Key words Flash visual evoked cortical potentials · Preoperative evaluation · Proliferative diabetic retinopathy · Vitrectomy

Zusammenfassung Die präoperative Untersuchung der visuell evo-

zierten Potentiale (VECP) vor einer Vitrektomie ist als Auswahlkriterium für Patienten mit guten Chancen für einen operativen Erfolg vorgeschlagen worden. Ein fehlendes Einzelblitz-VECP wird als Kontraindikation für einen operativen Eingriff angesehen. Eine 64jährige weibliche Patientin hatte an einem Auge eine ausgeprägte Glaskörperblutung bei einer proliferativen diabetischen Retinopathie. Präoperativ war im Einzelblitz-VECP keine Reizantwort nachweisbar. Intraoperativ wurde eine dichte Glaskörperblutung und retrohyaloidales Blut entfernt. Die Netzhaut war anliegend. Postoperativ fand sich ein seitengleiches Einzelblitz-VECP an beiden Augen mit normaler Latenz. Der Visus stieg von Lichtwahrnehmung auf 0,05 an. Eine ausgeprägte Glaskörperblutung kann präoperative VECP-Ableitungen beeinflussen. Eine fehlende Reizantwort im VECP muß bei Augen mit ausgeprägten Glaskörperblutungen mit Vorsicht beurteilt werden, damit Augen, bei denen eine Visusverbesserung möglich ist, nicht von der Operation ausgeschlossen werden.

Schlüsselwörter Einzelblitz-visuell evozierte Potentiale · Präoperative Untersuchung · Proliferative diabetische Retinopathie · Vitrektomie

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Introduction

Several studies concerning preoperative evaluation of retinal function with electrophysiological methods have been reported [2, 4–9, 12–14]. In most studies, the electroretinogram (ERG) has not been considered to be helpful because of the high variability of results [2, 5]. The presence of visual evoked cortical potentials (VECPs) following flicker stimuli of 10–30 Hz gives some clues as to postoperative function [5, 6, 8, 9, 13, 14]. Single flash VECPs are not considered to be helpful when present [5, 11]. However, the absence of a single flash VECP is considered to be an indicator of severe dysfunction of the inner retinal layers or the optic nerve [2, 9, 11]. Therefore, it has been concluded that ocular surgery should not be recommended when no flash VECP is recordable.

We observed a diabetic woman with a dense vitreous hemorrhage and a nonrecordable flash VECP in one eye. Following vitrectomy the flash VECP was normal and the visual function improved markedly.

Subjects and methods

Flash VECPs were recorded 2 days before and 8 days after vitrectomy using a technique similar to that described previously in detail [4, 5]. The examinations were performed separately on both eyes with dilated pupils. The electrodes were placed in standard positions at the vertex and at 2 cm above theinion. The ear served as the reference ground. The light stimuli were of 0.1 ms duration. The light intensity was 6.6 cd s m^{-2} . A total of 128 responses were averaged for each recording.

Normal values were obtained from one eye of ten persons with normal visual acuity. The mean P2 latency was $104 \pm 17 \text{ ms}$ and the mean N2-P2 amplitude was $13.4 \pm 4 \mu\text{V}$ (mean ± 1 SD).

Results

A 64-year-old woman had suffered from diabetes mellitus for 33 years. Within the last 6 years, repeated photocoagulation had been done because of proliferative diabetic retinopathy with recurrent vitreous hemorrhages. At our first examination the visual acuity in the right eye was 0.5. The left eye had only light perception without correct light projection. This visual loss had existed for about 9 months. The intraocular pressure was normal in both eyes. Slit-lamp examination revealed no rubeosis iridis in either eye. On the right eye an incipient cataract was found; in the left eye the lens showed a dense nucleus and posterior subcapsular clouding. Ophthalmoscopy showed proliferations on the disc and macular edema in the right eye. In the left eye there was a dense vitreous hemorrhage with no fundus visibility or red-light reflex. Echographic evaluation showed dense vitreous echoes and an attached retina. A flash VECP

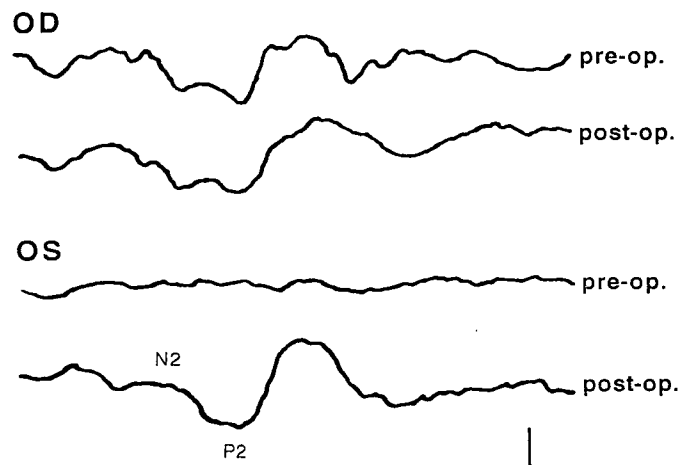


Fig. 1 Flash VECPs of both eyes of a 64-year-old diabetic patient with dense vitreous hemorrhage in the left eye. Preoperative recordings were done 2 days prior to surgery and postoperative recordings were obtained 8 days after surgery. In the right eye (OD) the pre- (pre-op.) and postoperative (post-op.) recordings showed a normal VECP. In the left eye (OS) there was a nonrecordable response preoperatively and a normal response postoperatively. N2 and P2 indicate the potentials that were measured for evaluation. The vertical calibration mark indicates $5 \mu\text{V}$ and the horizontal calibration mark indicates 20 ms

recording showed a normal response in the right eye and no measurable response in the left eye (Fig. 1). The P2 latency was 120 ms and the N2-P2 amplitude was $15 \mu\text{V}$ in the right eye.

The patient was informed that an improvement in visual function following vitrectomy was not to be expected. However, she asked to undergo surgery despite the very slight chance of visual recovery. Because she was otherwise in good health and the retina was attached, we respected the patient's wish. During surgery the lens was removed with ultrasonic fragmentation through the pars plana. A very dense vitreous hemorrhage was found and removed. The posterior vitreous was detached. A large amount of blood had to be removed from the retinal surface. The retina was totally attached. It was covered with epiretinal membranes with brownish inclusions. These membranes could be removed, but a small macular hole was found within a cystoid macular edema. Laser endocoagulation and tamponade with SF_6 was performed.

On day 8 following the surgery the retina was attached; the vitreous cavity was still partly filled with gas. The visual acuity had improved to 0.05. The intraocular pressure was normal. The flash VECPs showed similar responses in both eyes (Fig. 1). The P2 latency was 117 ms in both eyes. The N2-P2 amplitude was $9 \mu\text{V}$ in the right eye and $11 \mu\text{V}$ in the left eye.

Discussion

Preoperative prediction of the chance for functional recovery following pars plana vitrectomy would be valuable for the patient and the surgeon, especially in patients with severe vascular disease such as advanced proliferative diabetic retinopathy. Clinical data such as visual acuity or light projection are often unpredictable. Electrophysiological examinations allow an objective examination of the function of the retina and optic nerve. Several authors have investigated the use of the ERG and flash- and flicker-VECP recordings [2, 4–9, 12–14]. Although the ERG shows a correlation with retinal function in these patients, the variability of the findings is too great for prediction of the functional outcome in individual patients [2, 5]. VECPs, especially when recorded with flicker stimulation, have been shown to separate patients with a better chance for visual recovery [5, 6, 8, 9, 13, 14].

Vitreous hemorrhage influences the light intensity that reaches the photoreceptors. In eyes with dense vitreous hemorrhages, nonrecordable ERGs that become recordable following vitrectomy have been described [1, 10]. The ERG amplitudes depend largely on the light-stimulus intensity. In contrast, the VECP depends on the light-difference sensitivity with reversal stimuli and is therefore generally independent of the light intensity. Consequently, no influence of vitreous hemorrhage on flash and flicker

VECPs has been concluded from a large series of vitrectomy patients in a comparison of eyes with versus eyes without fundus visibility [5]. Recording of flash VECPs showed identical responses previous to and following vitrectomy in another series [12].

A nonrecordable flash VECP has been considered a contraindication for surgery [11]. Hutton and Fuller [9] found a mean visual acuity of hand motion in eyes with a nonrecordable VECP. Algvere et al. [2] reported no improvement following vitrectomy in eyes with a nonrecordable flash VECP. The findings in our patient indicate that a very dense vitreous hemorrhage can influence the results of VECP recordings. Fuller and Hutton [6] have described eyes with vitreous hemorrhage and severely reduced flicker VECPs that showed good visual acuity following surgery. As compared with pattern or flicker stimuli, the flash VECP is less affected by ocular or optic nerve damage and can be recorded even in eyes with severe pathology [3]. In several eyes with nonrecordable flicker VECPs, a flash VECP response may nonetheless be obtained [5]. To our knowledge, our patient is the first in whom even a single flash VECP has been nonrecordable due to severe vitreous hemorrhage. In our opinion, a nonrecordable flash VECP remains an argument against surgery in eyes with intermediate, if any, media opacities. In eyes with severe media opacities, an important visual improvement can occur despite a nonrecordable flash VECP.

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