BACKGROUND & OBJECTIVES: The major concern in carotid artery endarterectomy (CEA) procedure under general anesthesia (GA) is early detection of cerebral hypoperfusion during carotid cross clamping. Many studies have compared the prophylactic value of intraoperative neurologic monitors for detecting cerebral ischemia in patients undergoing CEA using selective shunting. We describe the practical application of near infrared spectroscopy (NIRS) and somatosensory evoked potentials (SEP) in patients undergoing CEA using routine shunting.

METHODS: 34 consecutive patients undergoing 40 CEA procedures with patch closure using routine shunting were included. Age ranged from 48 to 66 years. Standard anesthetic and monitoring techniques were used in all patients. Bilateral regional cerebral oxygen saturation (rSO2) was recorded continually before preoxygenation and continued until recovery from anesthesia, using cerebral oximeter (Somanetic INVOS5100 cerebral oximeter, COVIDIEN, USA)(Figure 1). An arterial line was placed for continuous blood pressure measurement before induction of GA. Mean arterial pressure was kept stable within a range of ±20% of the pre-operative level. SEP monitoring was performed from induction of to recovery from anesthesia (ISIS IOM Neuromonitoring, Inomed, GERMANY). The peak-to-peak amplitudes and latency of the primary ipsilateral cortical response N19/P22 complex were measured online. Any reproducible decrease of peak-to-peak amplitudes more than 50%, or increase of latency more than 10% vs the preclamping values, were documented as ischemic SEP change. After shunt insertion the surgical foam was informed of any sudden ischemic change of ipsilateral rSO2 or SEP. All patients were extubated in the operation theater. At this point patients were tested for the development of any new neurological deficit.

RESULTS: Reconstruction of ICA was successfully completed in all 40 surgeries. No patient developed permanent or transient new neurological deficit on the side of endarterectomy. The mean time between ICA cross-clamping and shunt insertion was 140±51 seconds, (range of 70 to 270 seconds). The mean shunting time was 36±29 minutes, (range of 22 to 60 minutes). Accepting 20% and 12% reduction from preclamping values as ischemic changes, 21 patients (62%) showed rSO2 ischemic changes after ICA cross-clamping. Five patients (12%), showed ischemic SEP change after ICA cross-clamping (Figure 2). rSO2 and SEP returned to pre-clamp value in all cases after shunt insertion (Figure 1). In 14 cases (35%) a sudden decrease in ipsilateral rSO2, prompted recheck of shunt function that after reposition and/or flushing the shunt, rSO2 returned to pre-malfunction values. In two of these patients SEP values changed significantly.

CONCLUSION: NIRS is based on the transmission and absorption of NIR light as it passes through tissue and is able to rapidly detect changes of the proportion of oxyhemoglobin and deoxyhemoglobin related to cerebrovascular perfusion changes. SEP is used to assess the functional status of somatosensory pathways during surgical procedures. With the beginning of cerebral hypoperfusion, changes of cerebrovascular O2 content precedes the functional changes of neural system. In term of early detection of cerebral ischemia in patients undergoing CEA procedures using routine shunting, NIRS seems to be more practical than SEP monitoring.