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Early Cognitive Functions in Patients after Embolization in Neuroradiological Suite – A Comparison of Two Anesthetic Techniques

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Abstract

Background: Less is known about prevalence of postoperative cognitive dysfunction after neurosurgical procedures. A Hindi version of Mini Mental State Examination (HMSE) is widely used for illiterate Hindi speaking population in the Indian subcontinent for assessment of cognitive dysfunction. The aim of the study was to assess effects of anesthetics on neurocognitive function in patients undergoing interventional procedure in neuroradiological suite.

Methods: Twenty five patients with intracranial arterio-venous malformations and cerebral aneurysms were randomized to receive intravenous (propofol) or inhalational anesthetic (isoflurane). HMSE was performed in the ICU at 1 hour and 24 hours of tracheal extubation.

Results: Baseline demographics like age and weight of patients differed significantly between the groups; however their cognitive functions were comparable. Intraoperative hemodynamic parameters like heart rate and mean arterial pressure were comparable between the two groups. Cognitive functions noted at the two time intervals in the postoperative period were also comparable between the two groups.

Conclusion: We observed that anesthetic technique did not affect post embolization cognitive function, but, a better hemodynamic stability was maintained with total intravenous anesthesia.

Keywords: Embolization; Intracranial pathology; Anesthesia; Cognitive function

Postoperative cognitive dysfunction (POCD) is an ill defined clinical condition that has no universally accepted diagnostic criteria. Mini mental state examination (MMSE) is widely used as a brief objective assessment of cognitive function and as a measure of changes in cognitive status [1]. A Hindi version of MMSE (HMSE) is widely used for illiterate Hindi speaking population in the Indian subcontinent for assessment of cognitive dysfunction [2] [Appendix 1]. POCD is common after cardiac surgery and non cardiac general surgical procedure [3-6]. Less is known about prevalence of POCD after neurosurgical procedures. Different anesthetic techniques have been tried in neurosurgical procedure with regard to rapid recovery and prompt neurosurgical assessment [7-11]. Current trend is towards use of total intravenous anesthesia (TIVA) for better recovery of neurocognitive function in postoperative period [7,9,10]. Studies have compared TIVA and inhalational techniques in terms of neurocognitive recovery in patients undergoing craniotomy [7-10]. But there is no literature regarding effects of anesthetics on neurocognitive function in patients undergoing interventional procedure in neuroradiological suite, where the importance of early recovery cannot be overemphasized. This pilot study was carried out to compare the two anesthetic techniques (TIVA versus Inhalational) with regard to recovery of neurocognitive function after neuro-radiological procedure in Hindi speaking population.

Materials and Methods

From October 2009 to February 2010, patients of American Society of Anesthesiologists (ASA) grade I - III, ages between 18-52 years undergoing coil or glue embolisation of vascular malformations in the neuroradiological suite were enrolled in the study. A written consent from the patient and approval by the local ethics committee was obtained. Patients with known allergy to any anesthetic drug, or iodinated dye, Glasgow Coma Score <15 and history of drug abuse were excluded from the study. HMSE was explained to patients during their pre-anesthetic check-up. Patients were randomly allocated in the two groups using a computer generated randomization chart.

Group 1 - Balanced anesthesia with isoflurane and fentanyl.

Group 2 - TIVA with propofol and fentanyl.

Prior to induction of anesthesia, baseline heart rate (HR), non-invasive blood pressure (NIBP), and HMSE score was noted. General anesthesia was induced with fentanyl 2 mcg/kg, propofol 2mg/kg and tracheal intubation was facilitated rocuronium 1mg/kg. Patients in Group1 received nitrous oxide-Isoflurane (end-tidal concentration 0.7% isoflurane) and patients in Group 2 received propofol infusion along with oxygen-air. Rocuronium was repeated every 30 minutes in the doses of 0.2 mg/kg and fentanyl 1 mcg/kg hourly. Anesthetics were titrated to maintain mean arterial pressure (MAP) between 20 % of baseline values. At the end of procedure, anesthetics were discontinued and neuromuscular block reversed. After tracheal extubation, patients were shifted to ICU for observation and supportive care. HMSE was again performed in the ICU at 1 hour and 24 hours of tracheal extubation by the same observer who was also blinded to anesthetic technique. Patients requiring ventilator support in the post procedure period were excluded from final analysis.

Data were analysed using software STATA 9.0 (College Station, Texas, USA). Data are expressed as Mean (SD) or number (%). The parameters between the groups were compared using the paired t test. The value of p less than 0.5 was considered significant.

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Results

Twenty five patients were enrolled for the study. Two patients (1 in each group) required postoperative mechanical ventilation as they suffered aneurysm rupture during coiling and were excluded from final analysis. Eleven patients in Group 1 and 12 patients in Group 2 were included in the study. Baseline demographics like age and weight of patients differed significantly between the groups; however their cognitive functions were comparable. [Table 1] Intraoperative hemodynamic parameters like HR and MAP were comparable between the two groups. Cognitive functions noted at the two time intervals in the postoperative period were also comparable between the two groups. [Table 1] The pathological conditions seen in our patients were arteriovenous malformations (6 patients each in both groups), arterio-venous fistula (1 patient in group 1 and 3 patients in group 2) and aneurysms (4 patients in Group 1 and 3 patients in group 2). No complications were recorded in any of the patients.

		Group 1 n = 11	Group 2	n = 12	p-value		
Age (years)		41.8(12.9)		27.8(7.6)			0.004
Male: Female		7: 4		7:5			
Weight (Kg)		62.6(6.0)		60.4(12.6)			0.29
Heart rate (beats/minute)	85.2(5.6)		78.3(7.6)			0.02	
Mean arterial pressure (mmHg)	80.3(7.1)		79.1(4.6)			0.46	
Baseline cognition		29(1)		29.1(0.8)			0.8
Cognition at 1hr	28.5(1.3)		28.6(1.3)			0.9	
Cognition at 24 hr		28(2.9)		28.7(1.1)			0.5

n = number of patients

Table 1: Demographic data, baseline hemodynamic parameters and cognitive functions as assessed by Hindi Mini-mental State Examination (HMSE) in the two groups [Mean (SD)]

Discussion

Balanced anesthesia with volatile anesthetics and opioids has been in common practice in neurosurgical settings. Studies comparing balanced anesthesia with inhalational anesthetics and TIVA with propofol and opioids had shown better recovery with TIVA based anesthesia in neurosurgical procedures [7-11]. Ali et al. [6] compared three anesthetic techniques in patients underwent transsphenoidal resection of pituitary with regard to intraoperative hemodynamic stability, postoperative emergence and recovery of early cognitive function. They found better intraoperative hemodynamic stability and early recovery of cognitive function in propofol group. Magni et al. [7] found no difference in emergence and recovery of cognitive function when compared balanced anesthesia with sevoflurane–fentanyl and TIVA with propofol–remifentanil in patients undergoing craniotomy for supratentorial intracranial surgery, but hemodynamics were better controlled in propofol-remifentanyl group. A comparative study between balanced anesthesia with inhalation anesthetic and TIVA based propofol and opioid combination in patients undergoing neuroradiological procedure has not been performed.

In our study, we found no difference in cognitive score of patients who underwent neuroradiological intervention for different intracranial vascular pathology from their baseline score in both the groups (balanced anesthesia versus TIVA). Also, the embolisation for different site and type of intracranial vascular pathology did not affect the post embolisation cognitive function from their baseline cognitive score. We observed a higher basal HR in group 1 as compared to group 2 which persisted throughout the procedure. This observed difference in HR in our study is possibly not a consequence of anesthetics used but may be related to some other factor or the randomization itself. There is no significant intraprocedure difference between the hemodynamics between the two groups but it was more controlled in group 2 due to better titration of intravenous anesthetics. In general, we did not come across any major complication intraoperatively or in immediate post embolisation period requiring active intervention in both the groups.

A small sample size could be considered limitation of this study. When we carried out the power analysis of this preliminary study, the sample size of n = 93 in each group were required to provide statistical power of more than 90%. For practical reasons, carrying out this study in such a large population within the stipulated time span was difficult. At the same time, a long term follow up was not conducted.

To conclude, in neuroradiological interventional procedure for intracranial vascular pathology, we observed that anesthetic technique do not affect post embolisation cognitive function. However, a better hemodynamic stability was maintained with TIVA based anesthesia.

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