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Research Article

Induction and Recovery Characteristics of Propofol during Emergency Neurosurgeries

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• Craniotomy; Head injury; Propofol

Abstract

Total intravenous anesthesia is a technique involving infusion and maintenance of anesthetic state with intravenous drugs alone. Propofol has three important characteristics of ideal TIVA agent, i.e. rapid induction, rapid metabolism and rapid recovery. In view of these advantages we studied the characteristics of propofol in total intravenous anesthesia for craniotomy.

Aim: To study induction and recovery characteristics of propofol during craniotomy

Methods: A total of 60 patients aged 18-60 years belonging to ASA I and II physical status with GCS more than 13 were included in the study. Exclusion criteria was GCS less than 13, ASA more than II, hemodynamic instability and other associated injuries. All patients were induced with propofol (2mg/kg) and maintained with 50 µg/kg/min infusion of propofol. Anesthesia was supplemented with fentanyl 2 mcg/kg and intubation facilitated with vecuronium 0.1 mg/kg. Based on hemodynamic signs, dose of propofol was adjusted in intraoperative period. Muscle relaxation was maintained with vecuronium 0.001mg/kg/min and analgesia with fentanyl 1 mcg/kg/hour intraoperatively. During skin closure, infusions were discontinued and neuromuscular blockade reversed at the end of surgery.

Result: Propofol enabled smooth and rapid induction in all patients with mean induction time of 17.32 ± 2.43 seconds. During maintenance, propofol provided adequate depth of anesthesia in 53 (88.33%) of the patients, as assessed by hemodynamic changes. Recovery was good with short response time of 11.78 ± 2.99 minutes and orientation time of 21.86 ± 6.68 minutes.

Interpretation and conclusion: Propofol based total intravenous anesthesia provides rapid induction and smooth recovery in most of the head injury patients.

ABBREVIATION

TIVA: Total Intravenous Anesthesia

INTRODUCTION

Inhalational agents have remained the routine choice for maintenance of anesthesia in spite of the development of new intravenous drugs. The principal reason is the availability of sophisticated delivery systems for volatile anesthetics which allows the anesthetist a fine degree of control of the concentration administered. Over the last couple of decades, the growth in knowledge of the pharmacokinetics and pharmacodynamics of intravenous anesthetic agents has resulted in a better understanding of the relationship between drug dose, blood concentration, biopha se concentration and effect. Advancement in computer technology and target-controlled infusion devices, total intravenous anesthesia has enjoyed a surge in popularity [1]. Hence, with these new developments and with the favorable cerebral pharmacodynamic properties of propofol, great interest has been shown in the use of total intravenous anesthesia for neurosurgery. Propofol produces dose dependent depression of CNS function. Propofol decreases ICP which is greater in patients with a higher baseline pressure. Propofol is associated with decrease in mean arterial pressure, cerebral perfusion pressure, cerebral blood flow and cerebral metabolic requirement for oxygen ($CMRO_2$) [2,3]. Cerebral auto regulation is maintained during propofol infusion. The short duration of action, antiemetic property and favorable effect on cerebral hemodynamics make propofol an appealing drug for use in neurosurgery [2,3]. It has also been observed that propofol requirement is decreased in neurosurgical patients (Table) [4].

MATERIALS AND METHODS

This prospective study was undertaken at college of medical sciences, Bharatpur, Chitwan, Nepal. Sixty ASA I and II adult patients aged between 18 to 60 years of either sex with head injury for emergency craniotomy were included in the study. Patients with Glasgow coma scale of less than 13, hemodynamic instability and other associated injuries were excluded from the study. All patients receive 2 µg/kg fentanyl bolus intravenously followed by 1% propofol as an induction agent in the dose of 2 mg/kg, over 20 seconds. Time taken from the administration of

Table: Observations during induction and recovery.	
Variables	**Time**
Loss of counting time	13.64 ± 2.1 seconds
Loss of verbal contact time	15.50 ± 2.2 seconds
Loss of eyelash reflex	17.32 ± 2.43 seconds
Response time	11.78 ± 2.99 minutes
Orientation time	21.86 ± 6.68 minutes

the drug to loss of counting, loss of verbal response and loss of eyelash reflexes were noted [5]. In all patients after induction (loss of eye lash reflex) tracheal intubation was facilitated using vecuronium bromide (0.1 mg/kg). Immediately after intubation propofol (50 µg/kg/min), vacuranium bromide (0.001 mg/kg/min) and fentanyl (1µg/kg/hour) continuous infusion were started [6]. Patients were observed for sympathetic over activity like tachycardia, increase in blood pressure, sweating and lacrimation to assess the adequacy of depth of anesthesia [7]. When mean arterial pressure (MAP) increased by 20% above the baseline or increase in heart rate of 20% above the base line, associated with other signs of increased sympathetic activity like lacrimation and sweating, indicating inadequate depth of anesthesia, the propofol infusion was increased by 20 to 30 µg/kg/min and observed for subsiding of these signs [8]. When MAP decreased by 20% below the baseline, propofol infusion was decreased by 10-20 µg/kg/min till the desired MAP was achieved. All the infusions were stopped at the time of skin closure. The response time, the time taken in minutes from the cessation of infusion to response to verbal commands after reversal, were noted. The time interval between cessation of infusion to recall his/her name or native place after extubation was taken as orientation time.

RESULTS AND DISCUSSION

The average age of patients was 35.5years and average weight was 63.4 kg. During induction the mean time to loss of counting was 13.64 ± 2.1 secs, loss of verbal contact time was 15.50 ± 2.2 secs, time for loss of eyelash reflex was 17.32 ± 2.43 seconds. It was seen that in 53 patients (88.33%) hemodynamic stability was maintained with propofol in the dose of 50 µg/kg/min. In 7 patients (11.66%) this dose had to be increased to achieve hemodynamic stability. At the end of the procedure, response time was 11.78 ± 2.99 minutes and the mean orientation time was 21.86 ± 6.68 minutes.

In selecting an anesthetic agent to be used for neurosurgical procedures, the anesthesia provider must consider the agent's effect on intracranial pressure, cerebral blood flow and cerebral metabolic rate of oxygen consumption. The anesthetic of choice for neurosurgical procedures for many decades has been thiopental. It meets the strict requirements for neurosurgical procedures because it protects the brain from ischemia and herniation by lowering intracranial pressure through decreases in cerebral blood flow and cerebral metabolic requirement of oxygen consumption. However, newer drugs including propofol provides comparable neuro protection as well as has shorter context sensitivity half-life that makes it well suited for neuro anaesthesia [9].

One of the objectives of modern anesthesia is to ensure adequate depth of anesthesia to prevent awareness without inadvertently overloading the patients with potent drugs. Clinical end points useful in assessing depth of anesthesia during induction include loss of verbal responsiveness and loss of eye lash reflex. Induction characteristics of a hypnotic can be studied by taking into consideration the loss of counting time, loss of verbal contact time and loss of eyelash reflex time [7]. In our study during induction with propofol, the mean time to loss of counting was 13.64 ± 2.1 secs, loss of verbal contact time was 15.50 ± 2.2 secs, loss of eyelash reflex was 17.32 ± 2.43 seconds.

Laryngoscopy and endotracheal intubation is often associated with hypertension and tachycardia because of the sympathoadrenal stimulation which is usually transient and lasts for 5 to 10 minutes which can result in deleterious events in patients with cardiovascular and cerebrovascular conditions [10]. In a prospective randomized study done by Singhal S and Neha [11] using thiopental sodium for induction, they observed a significant rise in mean arterial pressure and heart rate during laryngoscopy and intubation. In our study, after three minutes of intubation, we observed rise in MAP by 5.06 ± 3.01 mm of Hg above the baseline and rise in heart rate was 8.41 ± 4.06 beats per minute above the baseline.

The speed, reliability and quality of recovery from anesthesia are of paramount importance in TIVA. Schuttler et al. [12], employing propofol for TIVA in 20 patients observed mean response time of 7.9 minutes and mean orientation time of 11.9 minutes. In our study the mean response time was 11.78 ± 2.99 minutes and the mean orientation time i.e., recovery time was 21.86 ± 6.68 minutes.

CONCLUSION

Propofol provides smooth and rapid induction and favorable condition for laryngoscopy and intubation. Side effects associated with propofol infusion are minimal and do not come in the way of smooth induction and maintenance. Propofol provides hemodynamic stability throughout the procedure. Recovery from TIVA with propofol is fast and smooth, and devoid of any side effects or hemodynamic instability.

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