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TITLE: EFFECT OF INTRAVENOUS ANESTHETICS ON NEUROGENIC MOTOR EVOKED POTENTIALS RECORDED AT THE SPINAL AND SCIATIC LEVEL

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Because somatosensory evoked potentials have limitations in monitoring the motor tracts during spine surgery, motor evoked potentials (MEPs) are being employed to monitor for potential damage. However, little information is available regarding the effects of intravenous (IV) anesthetics on MEPs. Subsequently, we evaluated the effects of ketamine, fentanyl, sufentanil, and propofol on spinal (sp) and sciatic (sc) MEPs.

After animal review board approval 20 swine were (n=5 per group) studied. Anesthesia was induced (ketamine, 20 mg/kg IM) and maintained with supplemental halothane (0.3 MAC). Neuromuscular blockade was established with IV pancuronium. The animals were intubated and ventilated. MEPs were generated by delivering a 25 mAmp constant current stimulus (200 μsec, 4.3/sec) to insulated electrodes placed into the interspinous ligament at C_{6-7} and T_{1-2}. MEPs were recorded by bipolar 22G insulated electrodes inserted percutaneously at the L_4 level and bilaterally at the sciatic nerve. Ketamine was studied at infusion rates of 2-16 $mg \cdot kg^{-1} \cdot hr^{-1}$ followed by bolus doses of 2, 5 and 10 mg/kg. Fentanyl was studied at infusion rates of 1-5 $mcg \cdot kg^{-1} \cdot hr^{-1}$ and after a bolus dose of 10 mcg/kg. Sufentanil was evaluated at infusion rates of 0.1-0.5 $mcg \cdot kg^{-1} \cdot hr^{-1}$ and after a bolus dose of 1 mcg/kg. Propofol was evaluated at infusion rates of 2-12 $mg \cdot kg^{-1} \cdot hr^{-1}$ and after bolus doses of 0.5, 1 and 2 mg/kg. MEPs were measured for amplitude and latency after achieving steady state infusions and serially (every 30-60 seconds) after bolus doses. Data is presented as mean ± standard deviation. Analysis of variance for repeated measures was employed to detect significant changes in the MEPs.

There were no changes in the spMEPs for any drug dose studied. Ketamine induced no changes in the scMEPs. After the bolus dose of both fentanyl and sufentanil there was a decrease in amplitude of the scMEP of 30% ($p < 0.05$) at 2.5 min which resolved by 5 min. Narcotics induced no changes in latency. Infusion of propofol caused a consistent decrement in amplitude of the scMEP with a 50% reduction at 6 $mg \cdot kg^{-1} \cdot hr^{-1}$ and nearly complete loss (98%) at 12 $mg \cdot kg^{-1} \cdot hr^{-1}$. Bolus dosing of propofol induced significant changes in the scMEP (Table 1, $^{*}p < 0.05$, $^{\dagger}p < 0.005$) at 2.5 min. Full recovery occured at 5, 15 and 20 min for the respective doses (0.5, 1 and 2 mg/kg).

The data suggests that ketamine or narcotic infusions do not cause significant alterations in the scMEP. Bolus doses of narcotics do cause a transient decrease in amplitude and propofol causes severe alterations in both amplitude and latency. Based on this data the use of propofol and bolus administration of narcotics may be inappropriate when monitoring scMEPs.

Table #1.

	amplitude (μvolt)		latency (msec)	
Dose	0 min	2.5 min	0 min	2.5 min
0.5mg/kg	4.6±2.1	3.4±2.0*	8.16±0.4	8.22±0.4
1.0mg/kg	5.6±3.9	2.6±2.4†	8.11±0.5	8.31±0.5*
2.0mg/kg	6.7±5.9	0.8±0.5†	8.20±0.4	8.72±0.2†

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TITLE: ANESTHESIA FOR CAROTID ENDARTERECTOMY: PROPOFOL VS. ETOMIDATE-ISOFLURANE.

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Hemodynamic stability, avoiding both myocardial and brain ischemia, and early recovery, allowing for postoperative neurologic evaluation, are the major goals of anesthesia for carotid endarterectomy (CEA). The aim of the present IRB-approved investigation was to compare the hemodynamic stability and recovery characteristics of CEA-patients anesthetized with a total intravenous technique, based on propofol (P) and fentanyl (F), or with a classic technique, based on etomidate (E), isoflurane (I) and fentanyl (F).

40 consenting patients (ASA 2 and 3), scheduled for elective CEA, were randomly assigned to one of two groups. Anesthesia was induced with F, 1 μg/kg, and either E, 0.2-0.3 mg/kg (Group 1), or P, 1-1.5 mg/kg (Group 2), slowly (60 sec) administered to produce unresponsiveness. Patients were curarized with vecuronium, 0.1 mg/kg, intubated 3 min after induction, and mechanically ventilated with 50 % O_2 in N_2, maintaining normocapnia. Anesthesia was maintained with I, 0.3-1.6 end-tidal concentration (Group 1), or P, 50-200 μg/kg/min (Group 2), the initial P infusion rate being 150 μg/kg/min. I and P were titrated to maintain mean arterial pressure (MAP) at baseline value (on the ward). Hypertension and tachycardia were treated by increasing the administration of I or P, and by additional iv F. MAP decreases of more than 20 % below baseline were treated with neosynephrine, 100 μg, (if HR > 70 beats/min), or ephedrine, 5 mg, (if HR < 60 beats/min). Heart rate (HR) and blood pressure (radial artery catheter) were continuously recorded, and the (2-channel) EEG monitored for signs of cerebral ischemia. Emergence times, visual analogue scales for sedation (VAS), and scores for p-deletion and digital symbol substitution tests (DSST) at 30 and 60 min recovery were compared. Results (table) are expressed as mean values ± S.D. Data were analyzed using ANOVA and Chi-square, significance considered for $p \leq 0.05$.

$^{*}p \leq 0.05$, $^{**}p \leq 0.01$	Group 1 (n=19)	Group 2 (n=21)
age (years)	66±9.4	61±13
E or P for induction (mg/kg)	0.29±0.4	1.35±0.5
fentanyl first 20 min (μg/kg)	2.3±0.7	1.94±0.5
fentanyl total (μg/kg)	3.6±0.8	3.5±0.5
ephedrine first 20 min (mg)	6.6±4	7.1±12
ephedrine total (mg)	18±12	12±12
neosynephrine first 20 min (μg)	26±48	69±98
neosynephrine total (μg)	58±69	125±158
nr of pats. receiving vasopressors	17/19	19/21
shunt placement (EEG ischemia)	3/19	3/21
intraoperatieve awareness	0	0
perioperative myocardial infarction	0	0
anesthesia time (min)	138±25	136±40
emergence time (min)	10.8±4.8	13.5±6.7
VAS 30 min (mm) (0 mm = asleep)	48.5±21	63.5±15*
VAS 60 min (mm) (0 mm = asleep)	62±21	80±15**
p-deletion 30 min (% of preop score)	43±76	35±34
p-deletion 60 min (% of preop score)	61±72	81±51
DSST score 30 min (% of preop score)	25±30	36±24
DSST score 60 min (% of preop score)	46±23	74±31*
nausea 24 hr (number of pats.)	5/19	3/21

In patients undergoing carotid endarterectomy, a total iv anesthetic technique based on propofol resulted in equivalent hemodynamic stability but a better recovery profile than anesthesia with etomidate and isoflurane.