Title: THIOPENTONE-ISOFLURANE VS PROPOFOL IN NEUROANESTHESIA FOR INTRACRANIAL SURGERY

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Introduction. Although isoflurane is a cerebro-vascular dilator [1], the thiopentone-isoflurane sequence is a widely accepted anesthetic technique for intracranial surgery. Propofol, which is associated with a rapid recovery, has recently been shown to increase cerebro-vascular resistance [2]. So the present study was designed to compare and to evaluate both anesthetic techniques for intracranial surgery.

Methods. With ethical committee approval and informed consent, sixty ASA III adult patients with a Glasgow coma scale score (GCSS) of 15 scheduled for elective intracranial surgery were randomly assigned to two groups: Group I: thiopentone-isoflurane, 30 patients (48.6 ± 2.6 years, 66.6 ± 2 kg); Group II: propofol, 30 patients (54.5 ± 3 years, 66.1 ± 1.9 kg). All patients were premedicated with midazolam 0.1 mg.kg^{-1} IM. Anesthesia was induced in Group I with thiopentone 5 mg.kg^{-1} and in Group II with propofol 1.75 mg.kg^{-1}, followed 2 min. later in both groups by 2 mcg.kg^{-1} of fentanyl, 1.5 mg.kg^{-1} of lidocaine and 0.08 mg.kg^{-1} of pancuronium to facilitate intubation. Controlled ventilation was set to maintain P_{ET} CO_2 at 32-35 mmHg in both groups. Anesthesia was maintained in Group I with isoflurane 0.5 - 1.5% started at induction, N_2O 50% in O_2 and intermittent injections of fentanyl (mean total dose 1.63 ± 0.12 mcg.kg^{-1}.h^{-1}), and in Group II with a continuous infusion of propofol started at induction at a mean rate of 69 ± 3.5 mcg.kg^{-1}.min^{-1}, N_2O 50% in O_2 and intermittent injections of fentanyl (mean total dose 1.74 ± 0.14 mcg.kg^{-1}.h^{-1}). A 20 G malleable needle was placed in the lumbar subarachnoid space to measure lumbar CSF pressure (CSFP). Since no patient had an intracerebral lesion which might have been an obstacle to CSF flow, CSFP changes were taken to indicate ICP changes. Measurements of CSFP, direct mean arterial pressure (MAP), cerebral perfusion pressure (CPP=MAP-CSFP), central venous pressure (CVP), and heart rate (HR) were made before induction (baseline) and 1, 2 and 3 min. after induction. They were repeated just before intubation, at intubation (T) and 1 min. later, then just before application of the skull-pin head-holder (HH), at application of the HH, and 1 min. later. At the end of the procedure, administration of N_2O and isoflurane or propofol was stopped, and recovery was scored using the GCSS and by noting the times (1) to eye-opening, (2) to extubation, (3) to obey orders, (4) to speak and (5) to T/S orientation. Data are reported as $\bar{x}$ ± SEM and were analyzed using paired t-tests within groups with the Bonferroni correction for multiple comparisons and unpaired t-tests between groups. The Chi-square test was utilized to analyze recovery (GCSS); values of $p < 0.05$ were considered significant.

Results. Both groups were comparable (hemodynamic and demographic data) before induction, and for fentanyl dosage peroperatively. Surgery lasted 332 ± 18 and 336 ± 23 min. respectively. CSFP and MAP decreased in both groups after induction when only propofol or thiopentone were injected, whereas CPP remained above 70 mmHg. MAP decreased significantly more in Group II (Table I). During intubation and application of the HH, MAP and CSFP increased in both groups, but significantly less and for a shorter duration in Group II (Table I). Recovery was more rapid in Group II when considering GCSS 14-15 and times (1) (2) (3) (4) and (5) (described in Methods) which were about half of those of Group I (Table II).

Discussion. Propofol for induction and maintenance in neuroanesthesia is an intravenous agent which increases cerebro-vascular resistance [2] with a concomitant decrease in CSFP, thus maintaining a safe CPP, in contrast to isoflurane which dilates the cerebral vasculature [1]. The usual MAP and CSFP reactions to intubation and application of the pin head-holder, although present, were attenuated with propofol and fentanyl as reported recently [3] and recovery was significantly more rapid than after isoflurane.

References.

1. Archer et al. Anesthesiology 67: 642-648, 1987
2. Stephan et al. Anaesthesist 36: 60-65, 1987
3. Van Aken et al. Anesthesiology 68: 157-163, 1988

TABLE I: MAP, CSFP AND CPP DURING INDUCTION, INTUBATION (T) AND APPLICATION OF THE SKULL-PIN HEAD-HOLDER (HH) ($\bar{x}$±SEM) IN GROUPS I AND II

Induction min	0	1	2	3
MAP GI	93.3±2.5	83.9±2.8*	89.2±3.3	91.1±3.1^{+}
mmHg GII	95.4±2.2	88.4±2.5*	83.0±2.7*	80.2±2.5^{*+}
CSFP GI	11.8±1.1	8.2±0.9*	8.6±1.0*	9.8±1.0
mmHg GII	12.0±1.2	8.7±1.6*	8.8±1.2*	9.6±1.3*
CPP GI	81.5±2.7	75.8±2.4*	80.1±3.6	81.0±3.0
mmHg GII	83.4±2.2	79.7±2.9	74.2±2.9*	70.3±2.8*

Intub. min and HH min	Intubation (T) T-1	T	T+1	Appl. pin head-holder (HH) HH-1	HH	HH+1
MAP GI	84 ± 2	103 ± 3^{*+}	91 ± 3^{*+}	86 ± 2	112 ± 4^{*+}	92 ± 3*
mmHg GII	79 ± 3	89 ± 3^{*+}	84 ± 3^{+}	86 ± 2	98 ± 3^{*+}	88 ± 2
CSFP GI	11 ± 1	20 ± 2*	14 ± 2*	11 ± 1	15 ± 1^{*+}	13 ± 1^{*+}
mmHg GII	11 ± 1	17 ± 2*	13 ± 2	10 ± 1	12 ± 1^{*+}	9 ± 1^{+}
CPP GI	73 ± 2	82 ± 3^{*+}	79 ± 3*	76 ± 2	97 ± 4^{*+}	79 ± 3
mmHg GII	68 ± 3	72 ± 3^{+}	71 ± 3	77 ± 2	87 ± 3^{*+}	79 ± 3

* $p < 0.05$ within groups $^{+}$ $p < 0.05$ between groups

TABLE II: RATE OF RECOVERY ($\bar{x}$±SEM) IN GROUPS I AND II

Times	(1)	(2)	(3)	(4)	(5)
GI min	13 ± 1^{+}	17 ± 4^{+}	18 ± 2^{+}	34 ± 7^{+}	61 ± 11^{+}
GII min	8 ± 1^{+}	9 ± 1^{+}	11 ± 2^{+}	17 ± 3^{+}	30 ± 6^{+}

GCSS 14-15	0min	2min	5min	10min	30min	60min	120min	180min	240min	24h
GI %	0	0	3^{+}	13^{+}	50^{+}	63^{+}	83	87	93	100
GII %	0	3	17^{+}	41^{+}	76^{+}	86^{+}	90	93	97	100

$^{+}$ $p < 0.05$ between groups. GI = Group I, GII = Group II
Times (1)-(5): see "Methods". GCSS = Glasgow coma scale score