A comparative study of propofol and thiopental as induction agents for elective caesarean section

I. SIAFAKA - A. VADALOUCA - B. GATZIOU - G. PETROPOULOS and E. SALAMALEKIS

Summary: Twenty women for elective caesarean section received either propofol 2.3 mg/kgr or thiopental 4.4 mg/kgr for induction of general anaesthesia. Maintainance was similar for both groups. Mean arterial pressure and heart rate were recorded non-invasively before anaesthesia, during intubation, one and five minutes after intubation. There were no significant differences in haemodynamic response between the two groups. During intubation heart rate rose in both groups, but remained increased five minutes after tracheal intubation only in the thiopental treated women ($p<0.05$). There was no significant neonatal depression as assessed by Apgar Scores and blood gas analyses. Propofol appears to be a suitable alternative to thiopental as an induction agent for obstetric anaesthesia.

Key words: Anaesthetics; Intravenous; Propofol; Thiopental, Anaesthesia obstetric.

INTRODUCTION

Thiopental has been the routine induction agent of anaesthesia for Caesarean section since the 1930's because of its rapid and predictable action ([1]). However it can also cause marked decreases in arterial blood pressure and this together with the rapid placental transfer, may induce some depression on the fetus ([2]).

Propofol, an alkylphenol, has properties which suggest that it might be a useful alternative to thiopental. The suspension has a PH of 7.0, which makes it less likely to cause local tissue or vascular complications. The cardiovascular response to tracheal intubation is less than with thiopental. Propofol is more rapidly metabolised and excreted than the barbiturates ([3]). In non-obstetric anaesthesia propofol has been shown to offer advantages. However the physiological and pharmacokinetic changes of pregnancy demand that detailed studies of propofol be made before routine use of topofol can be advocated in obstetrics.

Department of Anaestesia, Areteion Hospital, University of Athens
Athens (Greece)

MATERIALS AND METHODS

The protocol was approved by the University Ethical Comittee and verbal consent was obtained from all patients. Twenty healthy women with an uncompromised term pregnancy, due to be delivered by elective Caesarean section, were randomly allocated to receive either propofol or thiopental as an induction agent.

The initial intravenous fluid was Ringer's Lactated solution with approximately 500 ml in-

Table 1. – *Patient data, (mean, SD).*

Anaesthetic Agent	Dose (mg)	Age (years)	Weight (kg)	Gestation (weeks)
Thiopental (10)	355.5 (40.8)	29.8 (5.20)	80 (9.0)	38.2 (0.9)
Propofol (10)	200.4 (44.7)	32.9 (3.0)	86.2 (11.3)	38.1 (0.6)

fused before intubation. Following preoxygenation and institution of left lateral tilt, anaesthesia was induced with either propofol or thiopental, the amount of drug given, was determined by loss of eyelash reflex. Succynilocholine 100 mg was given to facilitate tracheal intubation and maintenance was by inhalation of 50% nitrous oxide in oxygen, supplemented by 0.5% isoflurane.

Neuromuscular block was provided by attracurium 0.5 mg/kgr. Syntocinon 5 units and fentanyl 2 μg/kgr were given intravenously immediately after delivery.

Electrocardiogram and arterial blood pressure were monitored, automatically and recorded on paper before anaesthesia (B), during intubation (D), one minute after intubation (1′) and five minutes later (5′).

Induction to delivery (I-D) and uterine incision to delivery (U-D) times, were recorded. The total dose of thiopental and propofol was noted.

From a piece of double clamped umbilical cord an arterial and venous sample were taken for PH and blood gases tensions. In addition a maternal arterial sample was also taken at delivery for blood gases analysis. The Apgar Scores of infants were recorded at 1 and 5 min from birth.

Results are presented as the mean ± SD. Statistical analysis was performed using the students-t-test for parametric data, the two-way analysis of variance for repeated measures and scored data were analysed with the Mann-Whitney test. A level of 0.05 was considered statistically significant.

RESULTS

Both groups were comparable with regard to age, weight and period of gestastion. The total induction dose for thiopental was 355.5 mg and for propofol 200.4 mg which expressed in mg/kg was 4.4 mg and 2.3 mg respectively (Table 1).

There were no significant differences in haemodynamic response between the two groups, before anaesthesia, during intubation, one and five minutes after. The variations of mean blood pressure (BP) recordings, in four different times, are shown in figure 1. There was no significant difference between the two groups ($r=0.58$).

In the thiopental group we observed that the mean values of BP one and five minutes after intubation did not differ from the baseline values. On the contrary, there was a rise ($P=0.004$) in mean blood pressure during intubation, compared with baseline value (B). In the propofol group we observed the same variations in mean BP, but there was less increase during intubation (D).

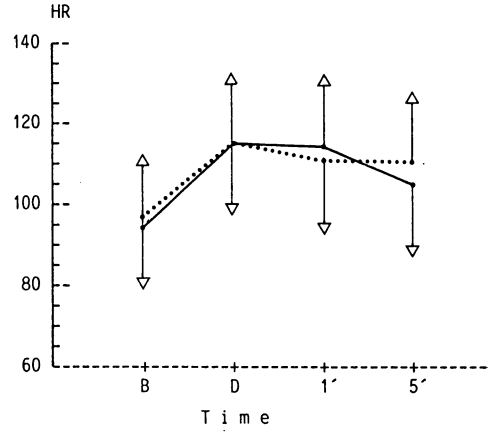

Fig. 1. — Mean arterial pressure (MAP) before induction of anaesthesia (B), during intubation (D), one minute (1′) and five minutes (5′) after intubation in the propofol (—) and thiopental (...) groups (mean, SD).

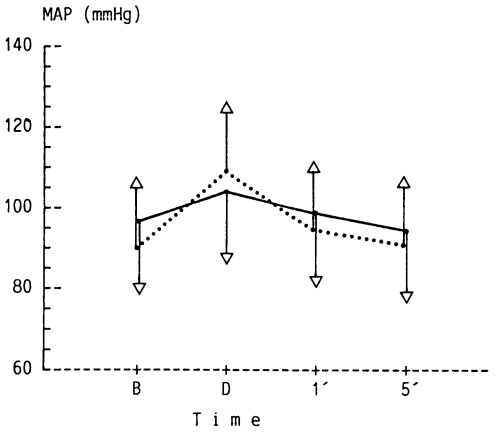

Fig. 2. — Maternal heart rate variations before induction of anaesthesia (B), during intubation (D), one minute (1') and five minutes (5') after intubation (5') in the propofol (—) and thiopental (...) groups (mean, SD).

The effects of thiopental and propofol upon heart rate are shown in figure 2. During intubation heart rate rose in the thiopental group and remained increased one and five minutes after tracheal intubation ($p<0.05$). In the propofol group heart rate rose during intubation, compared with baseline values (B), but decreased five minutes after. There were no differences in the I-U times wich ranged from 1 to 15 minutes or the U-D times which were alla less 60 seconds (Table 2). The average Apgar Scores at one and five minutes were 8 (5 to 10 range) and 10 (7 to 10 range) for thiopental and 9 (7 to 9) and 10 (10 to 10) for propofol (Table 3).

Table 2. – *Time intervals I-U and U-D (mean, SD).*

	Thiopental	Propofol
I-U time, minutes	6 (4.02)	6 (3.08)
U-D time, seconds	38.5 (17.0)	40.7 (12)

U-D = Time from induction to uterine incision
I-U = Time from uterine incision to delivery

Table 3. – *Apgar Scores (median, range).*

Apgar Score (0-10)	Thiopental (10)	Propofol (10)
1'	8 (5-10)	9 (7- 9)
5'	10 (7-10)	10 (10-10)

Table 4. – *Blood gas values of maternal artery and umbilical vein and umbilical artery at delivery (mean, SD).*

Umbilical vein	Thiopental	Propofol
Umbilical vein		
PH	7.36 (0.01)	7.36 (0.02)
PO_2 (mmHg)	30.15 (3.54)	29.57 (2.68)
PCO_2 (mmHg)	40.36 (4.10)	38.58 (3.26)
BE (mmol/lit)	–2.42 (1.6)	–2.96 (1.37)
SAT	55.2 (8.4)	53.9 (5.70)
Umbilical artery		
PH	7.32 (0.10)	7.31 (0.02)
PO_2 (mmHg)	20.65 (1.97)	19.65 (3.19)
PCO_2 (mmHg)	45.76 (4.16)	47.18 (5.37)
BE (mmol/lit)	–2.47 (1.92)	–3.38 (2.14)
SAT	29.11 (4.67)	26 (8.41)
Maternal artery		
PH	7.42 (0.01)	7.41 (0.01)
PO_2 (mmHg)	195.27 (47.88)	177.48 (44.25)
PCO_2 (mmHg)	29.02 (2.91)	29.88 (2.46)
BE (mmol/lt)	–3.78 (2.54)	–4.01 (1.01)
SAT	99.14 (0.56)	98.84 (0.46)

The maternal arterial and umbilical venous and arterial blood gases and PH are shown in Table 4. None of the variations was statisticaly significant.

DISCUSSION

Our results suggest that induction of anaesthesia with propofol did not cause more hypotension than thiopental and agree with previous reports [4]. However, Moore *et al.* [5] conclude that blood pressure was lower in the propofol group during the induction delivery interval but statistical analysis was performed with the unpaired t-test. In our study a comparison of individual blood pressure with

repeated measured analysis of variance was used.

Hypotension is usually maximal from two to three minutes after induction. In this study this effect may have been masked by the coincident administration of succynilocholine, cricoid pressure and intubation. No differences were noted between awake mean pressure (B) and post-intubation pressures one and five minutes later in both groups ($p=0.58$).

Although there was a significant rise in mean pressure during intubation (D), compared with the baseline values (B) yet this rise in pressure was less with propofol than with thiopental ($p=0.004$). These findings are in agreement with other comparative studies ([6]).

Most workers have usually demonstrated that propofol causes very litle change in heart rate on induction of anaesthesia ([7]). In this study both groups showed a rise in heart rate following induction which peaked during intubation. This was probably due to the added stimulus of rapid sequence intubation. Post-intubation rise in heart rate was unchanged in the thiopental group but a tendency towards baseline values was found five minutes after intubation with propofol.

Crawford *et al.* ([8]) have suggested that the duration of I-D interval had little effect in determining the clinical condition of the infant at delivery, but a long U-D interval (>90 seconds) was associated with poor condition. In our study U-D times were less than 90 sec in both groups. Both groups had satisfactory neonatal Apgar scores at one and five minutes and umbilical cord blood gases values.

Other workers have shown lower Apgar Scores, using a dose of propofol 2.8 mg/kgr ([9]).

We agree with Valtonen *et al.* ([4]) who report no clinically significant depression of the neonates indicated by the Apgar Scores or blood gases in either the propofol or the thiopental group.

From our study we conclude that propofol causes less variation in maternal mean blood pressure and heart rate than thiopental during rapid sequence induction of anaesthesia for selective caesarean section and had no adverse effects on the neonates. The promising results warrant further investigation into the use of propofol in obstetric surgery.

REFERENCES

1) Solomons E. B.: "Pentothal sodium in obstetrics". *Irish Journal of Medicine Science, 132,* 746, 1936.
2) Finster M., Mark L. C., Morishima H. O., Moya F., Perel J., James L. S., Dayin P. G.: "Plasma thiopental concentrations in the newborn following delivery under thiopentone nitrous oxide anesthesia". *American Journal of Obstetrics and Gynecology, 95,* 621, 1966.
3) Dundee J. W. and Clarke R. S. J.: "Propofol". *European Journal of Anaesthesiology, 6,* 5, 1989.
4) Valtonen M., Kanto J., and Rosenberg P.: "Comparison of propofol and thiopentone for induction of anaesthesia for elective caesarean section". *Anaesthesia, 44,* 758, 1989.
5) Moore J., Bill K. M., Flynn R. J., McKeating K. T., and Howard P. J.: "A comparison between propofol and thiopentone as induction agents in obstetric anaesthesia". *Anaesthesia, 44,* 753, 1989.
6) Gin T., Gregory M. A., and OH T. E.: "The haemodynamic effects of propofol and thiopentone for induction of Caesarean Section". *Anaesth. Intens. Care, 18,* 175, 1990.
7) Fahmy N. R., Alkhouli H. M., Sunder N., Smith D., Kelley M. M.: "Diprivan: a new intravenous induction agent. A comparison with thiopenta". *Anesthesiology, 63,* A363, 1988.
8) Crawford J. S., and Davies P.: "Status of neonates delivered by elective caesarean section". *Br. J. Anaesth., 54,* 1015, 1982.
9) Celleno D., Capogna G., Tomasetti M., Constantino P., Di Feo G., Nisini R.: "Neurobehavioural effects of propofol on the neonate following elective caesarean section". *British Journal of Anaesthesia, 62,* 649, 1989.

Address reprints requests to:
E. SALAMALEKIS
30 Roumelis Str.
Chalandri 15233
Athens (Greece)