COMPARISON OF PROPOFOL AND THIOPENTONE AS INDUCTION AGENTS FOR LAPAROSCOPY

W K Boey, A Kumar

ABSTRACT

Fifty two patients for laparoscopy were randomly divided into two groups and induced with propofol 2 mgkg-1 or thiopentone 4 mgkg-1. The two groups were similar for race, age, weight, premedication and duration of operation. General anaesthesia with endotracheal intubation, nitrous oxide/oxygen with 0.5% halothane and muscle relaxation with suxamethonium was used throughout.

Induction times were similar for both groups. The systolic, diastolic blood pressures and heart rates of both groups fell significantly from baseline values two minutes after induction. The fall in systolic blood pressure was greater with propofol ($p<0.01$). Following intubation the rise in systolic, diastolic blood pressures and heart rate above baseline values were greater with thiopentone ($p<0.001$ for all three variables). Discomfort on injection and involuntary movements were significantly more common with propofol. Laryngospasm was significantly more common with thiopentone.

Patients given propofol could sit up unaided earlier after the anaesthesia ($p<0.01$). There was no difference in eye opening and orientation time.

Keywords : Propofol, thiopentone, intravenous anaesthetics, laparoscopy

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INTRODUCTION

Laparoscopy and hydrotubation is a short gynaecological operation which is sometimes done as a 'day surgery'. A smooth induction with a clear rapid recovery is essential for the successful anaesthesia of this procedure.

Propofol ('Diprivan'), a new anaesthetic agent with a short elimination half-life[1], appears to have properties which make it a suitable induction agent for the anaesthesia of this procedure.

This trial compared thiopentone with propofol as induction agents for laparoscopy and hydrotubation with respect to induction and recovery characteristics as well as side effects.

MATERIALS AND METHODS

Only patients of American Society of Anesthesiologists (ASA) Class I and II with no known history of drug allergies or anaesthetic problems were included in this study. Informed consent was obtained from all patients and the study was approved by the 'Clinical Trial Committee' of the Ministry of Health, Singapore.

Fifty two patients were randomly allocated into two groups; one group receiving propofol and the other thiopentone. The anaesthetist knew the induction agent used while the patient room and the recovery room personnel monitoring the patient's recovery did not. All patients were premedicated one hour before surgery with intra-muscular pethidine 1 mgkg-1 and phenergan 0.5 mgkg-1. All patients had their home or office telephone number recorded before the anaesthesia and were informed that they would be asked for this number when they awoke from the anaesthesia.

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The patients were preoxygenated for 3 minutes and then asked to begin counting as the induction agent (thiopentone 4 mgkg-1 or propofol 2 mgkg-1) was given over 20 seconds. Induction time was taken to be the time from the start of the injection till the time the patient stopped counting. Induction side effects (Table I) were monitored. Two minutes after induction, intravenous suxamethonium chloride 1 mgkg-1 was given and the patient intubated. Anaesthesia was maintained with nitrous oxide (70%), oxygen (30%), 0.5% halothane and intermittent boluses of 25 mg suxamethonium chloride (this was given when there were clinical signs of return of muscle power). Intravenous atropine 0.6 mg was given just before the first top up dose of suxamethonium chloride. The blood pressure and pulse rate were recorded just before induction (baseline values) and at two minute intervals throughout the operation using a dinamap (Critikon) automatic blood pressure machine with recording capability.

Table I
Side Effects Monitored During Induction and Recovery

INDUCTION SIDE EFFECTS	
Discomfort on injection	Masseter spasm
Cough	Tremor
Bronchospasm	Hiccup
Laryngospasm	Twitching
Flush/rash	Apnoea (respiratory arrest ≥30 secs)
Involuntary movements not related to light anaesthesia	
RECOVERY SIDE EFFECTS	
Nausea	Bronchospasm
Laryngospasm	Flush/rash
Vomiting	Elation/euphoria
Headache	Depression/crying
Restlessness	Confusion
Venous thrombophlebitis	

At the end of the procedure, halothane was switched off as soon as the laparoscope was removed from the abdomen. The moment the wound was switched up, nitrous oxide was switched off and the patient put on 100% oxygen and allowed to wake

up. If the procedure progressed beyond 30 minutes due to complications, the patient was excluded from the study.

Recovery characteristics at the recovery room were monitored by a nurse who did not know which drug was used for induction. The patients were asked repeatedly to open their eyes after the anaesthesia and the time they could first do so was recorded. They were also asked for the prearranged home or office telephone number and the time when they could recall it was noted. The time the patient could sit up unaided was also recorded. Recovery side effects were monitored (Table I). Any antiemetic or analgesic required by the patient in the recovery was also noted. All patients were asked just before discharge from the recovery room whether they were satisfied with the anaesthesia and whether they would have the same anaesthesia again. The next day, the vein used for the intravenous injection was checked for thrombophlebitis.

STATISTICAL ANALYSIS

The systolic, diastolic blood pressures and heart rate were analysed in two ways:

1. WITHIN GROUP ANALYSIS (PAIRED T-TEST):

The observations at the different time intervals were compared to the baseline values for significant differences within the same drug group. (Eg. Systolic blood pressures at 2nd min, 4th min etc were compared to the baseline value within the thiopentone group.)

2. BETWEEN GROUP ANALYSIS (UNPAIRED T-TEST):

The changes in the observations from baseline values at various time intervals were compared between the two groups for significant differences (eg. Change in systolic blood pressure from baseline value at the 2nd minute in the propofol group was compared to the change in the systolic blood pressure from baseline value at the 2nd minute in the thiopentone group).

Student's t-test was used to test for differences between the groups for the patient and anaesthetic data (Table II).

Wilcoxon rank sum tests were used to examine the differences between the two groups for the following: a) opening of eyes time, b) orientation time, c) sit up time, as the data were skewed (Table III).

Chi-square tests were used to examine the difference between the two groups with respect to proportions of study subjects experiencing induction and recovery side effects. Where frequencies were small, Fisher's exact probability tests were used instead of the chi-square tests (Table IV).

RESULTS

No patients were excluded in this study. The two groups were comparable with respect to race, age, weight, duration from time of premedication till induction, as well as the duration of the operation. The induction times were almost identical for both groups (Table II).

Table II
Patient And Anaesthetic Data

	PROPOFOL (N = 26)	THIOPENTONE (N = 26)
RACE		
Chinese	24	24
Caucasian	1	1
Indian	1	0
Malay	0	1
AGE (years)	33.8 ± SD 4.3	34.2 ± SD 5.5
WEIGHT (kg)	52.4 ± SD 7.1	53.5 ± SD 10.6
PREMEDICATION DURATION* (mins)	60.1 ± SD 14.1	58.5± SD 11.2
ANAESTHESIA DURATION** (mins)	13.5 ± SD 4.7	13.8 ± SD 4.3
INDUCTION TIME (secs)	28.2 ± SD 7.6	28.1 ± SD 4.3

No statistical difference was found between the two groups for the above variables.

* Premedication duration = Time from premedication of patient till the time of intravenous induction.

** Anaesthesia duration = Time from intravenous induction till the time the anaesthetic gases were turned off.

Table IV
Side Effects during Induction and Recovery

	Propofol (%)	Thiopentone (%)
Induction Side Effects		
Discomfort on injection*	34.6	7.7
Laryngospasm*	0	19.2
Involuntary movements not related to light anaesthesia*	23.1	3.9
Recovery Side Effects		
Nausea	3.9	0
Vomiting	3.9	0

* $p<0.05$

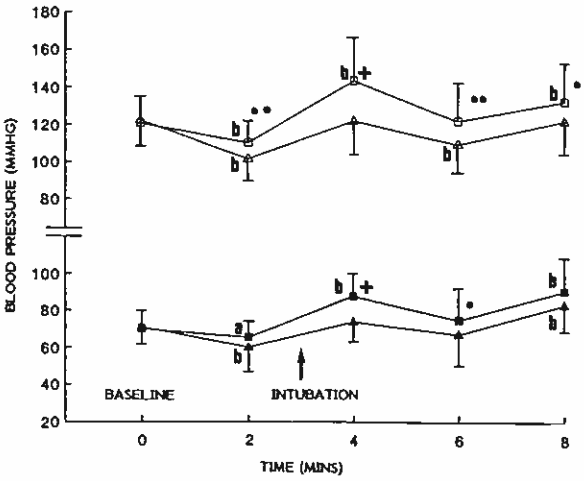
Table III
RECOVERY CHARACTERISTICS

Variable Monitored+ (mins)	Propofol (N = 26) Mean	SD	Range	Thiopentone (N = 26) Mean	SD	Range
1. Opening of Eyes	3.2 ±	1.9	(1 to 10)	3.5 ±	1.6	(1 to 9)
2. Orientation Time (Time Patient Could Recall Phone Number)	4.5 ±	1.9	(3 to 11)	4.7 ±	1.9	(3 to 11)
3. Sit Up Time*	13.0 ±	7.6	(5 to 32)	22.6 ±	12.1	(4 to 49)

\+ All variables were taken from the end of anaesthesia till the time the patient could respond as instructed.

* $p<0.001$

Fig. 1. Trend of Systolic and Diastolic Blood Pressures (mean± SD) following Induction of Anaesthesia



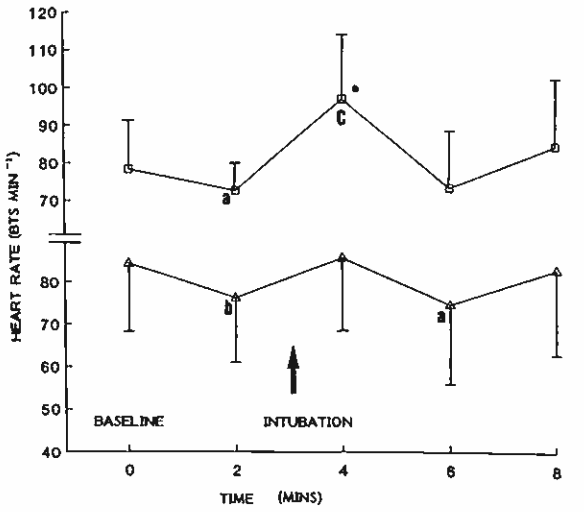
(⊟, ■) : Systolic, diastolic blood pressure for thiopentone group.

(△, ▲) : Systolic, diastolic blood pressure for propofol group

*p<0.05, **p<0.01, + p<0.001 : Significantly different between groups, comparing changes from baseline values.

ᵃp<0.05, ᵇp<0.001 : Significantly different from baseline value for within group comparison.

Fig 2. Trend of heart rate (mean± SD) following induction of anaesthesia.



(⊟) : Heart rate of thiopentone group.

(△) : Heart rate of propofol group

*p<0.001 : Significantly different from baseline for within group comparison.

ᵃp<0.05, ᵇp<0.005, ᶜp<0.001 : Significantly different between groups, comparing changes from baseline.

The systolic and diastolic blood pressures of both groups following induction are displayed in Fig 1 and that of heart rates in Fig 2.

In the 'within group' analysis, the mean systolic, diastolic pressures and heart rates of both groups fell significantly from baseline values on induction and rose following intubation. Unlike the patients in the thiopentone group the mean systolic, diastolic pressures and heart rate of the patients in the propofol group did not rise significantly above baseline values one minute after intubation.

The 'between group' analysis showed that the mean systolic pressure of the propofol group fell significantly greater than that of the thiopentone group ($p<0.01$) on induction. One minute after intubation, the rise in the mean systolic, diastolic pressures and heart rate above the baseline values of the thiopentone group were significantly greater than that of the propofol group ($p<0.001$ for all three variables).

For both groups, there was no difference in the ability of the patients to open their eyes on command and to recall their phone numbers. The time the patient could sit up unaided was significantly better for the propofol group ($p<0.001$) (Table III).

All the side effects seen are listed in Table IV. During induction, discomfort on injection and involuntary movement not related to light anaesthesia were significantly more common in the propofol group ($p<0.05$) while laryngospasm was significantly more common in the thiopentone group ($p<0.05$). There was no difference in the recovery side effects. No patients in either group required analgesics in the recovery room. All except one patient in both groups were satisfied with the anaesthesia and indicated that they would not mind having the same anaesthesia again.

DISCUSSION

Anaesthesia for laparoscopy and hydrotubation requires a smooth induction, a smooth maintenance and a clear rapid recovery. The induction agent plays an important role in achieving the ideal anaesthesia for this short procedure.

Induction and recovery characteristics can be affected by other factors other than the induction agent. In this study, factors which could affect these characteristics such as the type of premedication, the time from premedication to induction and the type and duration of the general anaesthesia were all not different between the two groups. The duration of anaesthesia was almost identical for both groups of patients (13.5 ± SD4.7 mins for propofol and 13.8 ± SD4.3 mins for thiopentone).

This study is important in the local context as no data is available on the induction dose and response characteristics of the local population to propofol as an induction agent. Data obtained so far has been from studies on Caucasian patients. The dosage of propofol used in this study was determined by a pilot trial. In the pilot trial we used 1.5 mgkg-1 of propofol as the induction dose (manufacturer's recommended dose is between 1.5-2.0 mgkg-1). We chose this lower dose because of our clinical impression that local patients seemed generally to need less induction agent compared to Caucasians. The results of this pilot trial showed that the local patient could be induced adequately with this dose though the induction time was prolonged in a few cases. Thus we decided to use 2 mgkg-1 of propofol and 4 mgkg-1 thiopentone (our usual induction dose) in the present study. Rolly[2] and Cumming[3] found 2 mgkg-1 of propofol to induce 95% and 87% of their patients in their studies. However, their patients were not premedicated while ours had premedication with pethidine and phenergan. All our patients were induced successfully with this dose of propofol and we found the induction times for both drugs acceptable and almost identical at these dosages (both have a mean of 28 secs). Our induction times are closer to Cummings' (28.9 secs) than Rolly's (34 secs).

There was a greater incidence of discomfort on injection (34.6%) and involuntary movement (23.1%) during induction with propofol but we did not find it a major problem. The discomfort was mild when present and no patient withdrew the hand because of the pain. The veins used were those which we

routinely cannulated for this operation and were mainly on the dorsum of the hand. We did not not specifically use the larger veins in the forearm or cubital fossa which could have reduced the incidence of discomfort on injection[4]. There was a greater incidence of laryngospasm with thiopentone (19.2%) but these were mild and did not require intervention. The laryngospasm could be due to the lightening of anaesthesia from thiopentone as we waited two minutes before paralysing and intubating the patients. We wanted to record the cardiovascular parameters at two minutes in the unstimulated patient. We did not encounter apnoea (respiratory arrest equal to or exceeding 30 seconds) in both the groups during induction. We decided on 30 seconds rather than 15 seconds as the duration of significant apnoea as one would normally have to assist the ventilation if apnoea exceeded this time limit.

The haemodynamic system was depressed by both induction agents in the unstimulated patient with the lowering of systolic and diastolic pressures and heart rates. Propofol, however, depressed the systolic blood pressures more ($p<0.01$). Nightingale[5] found similar changes in the blood pressures when he compared induction with propofol and thiopentone though in his study the heart rate rose slightly instead of falling. We did not find the fall in the systolic blood pressure of both groups a problem as they were mild and did not require treatment. Our protocol required us to delay the intubation for two minutes. An earlier intubation would have reduced the fall in the blood pressure as both systolic and diastolic pressures and the heart rates all rose with both the agents after intubation. The rise in these three variables above baseline values was very significantly greater with the thiopentone group ($p<0.001$ for all three variables). The values of these three variables one minute after intubation were not different from the baseline values for the propofol group. Propofol thus appeared to have the desirable effect of obtunding the rise in blood pressure and heart rate following intubation. Similar findings were reported by Harris[6] and Patrick[7].

The times the patients could open their eyes or remember their phone numbers after the anaesthesia were not different for both groups of patients. These early recovery signs were probably affected more by the maintenance anaesthetic agents (nitrous oxide and halothane) than the induction agent. Mackenzie[8] found an earlier recovery for propofol compared to thiopentone, for similar parameters. However he used enflurane and nitrous oxide for maintenance. The time the patients could sit up unaided which is a reflection of psychomotor recovery, was significantly earlier with propofol ($p<0.001$). Mackenzie[8] using more sophisticated tests for psychometric function also found an earlier return to normal with propofol compared to thiopentone. An early psychomotor recovery is advantageous as the patients would be able to look after themselves earlier. Thus they would be able to be discharged home earlier if they were done as day surgery cases. The incidence of recovery side effects was not different and was low in both groups. Patient acceptance for this technique of anaesthesia was high with no difference between the two induction agents.

In conclusion, propofol is a smooth induction agent with a high patient acceptance. Compared to thiopentone, it depressed the cardiovascular system more, had more discomfort and involuntary movement on injection but had the advantage of a reduced haemodynamic response to intubation as well as an earlier recovery. In the local population, 2 mgkg-1 of propofol is adequate for induction and is comparable to thiopentone 4 mgkg-1 in the induction time.

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