

# A Comparison of total intravenous anaesthesia ( TIVA ) to conventional general anaesthesia for day care surgery.

V Buchh, B Saleem, F Reshi, A Hashia, S Gurcoo, A Shora, S Qazi

## Citation

V Buchh, B Saleem, F Reshi, A Hashia, S Gurcoo, A Shora, S Qazi. *A Comparison of total intravenous anaesthesia ( TIVA ) to conventional general anaesthesia for day care surgery.*. The Internet Journal of Anesthesiology. 2008 Volume 22 Number 1.

## Abstract

**Background :** The aim of the study was to determine propofol based TIVA as a technique for day care gynaecological surgery and to compare TIVA with conventional general anaesthesia in terms of intra and post operative haemodynamic profile , post operative recovery and undesirable sequelae like post operative nausea and vomiting. Patients and Methods One hundred twenty ASA grade I adult consenting patients in the age group of 20-45 yrs undergoing diagnostic gynaecological laparoscopy or abdominal tubal ligation as elective day case surgeries were divided randomly into two groups of 60 each. GROUP I CONVENTIONAL GA ( CONTROL GROUP) GROUP II TIVA( STUDY GROUP). No premedication was given in either group. In the control group, induction of anaesthesia was achieved with thiopentone Na 3-5mg/kg and maintenance with N<sub>2</sub>O/O<sub>2</sub>/isoflurane (0.2-0.6%) as judged clinically . Isoflurane was tapered at the end of surgery and stopped at skin closure . N<sub>2</sub>O was stopped at skin closure. In the study ( TIVA) group patients were induced with propofol 2-2.5mg/kg and maintained on a continuous infusion of 3-12mg/kg/hr with air in 33% oxygen mixture. The rate of propofol infusion was adjusted according to need of anaesthesia depth . Propofol was tapered towards end of case and stopped at skin closure . Both groups received 0.5mg/kg atracurium for intubation and further maintained on top up doses .Analgesia in both was provided with 2µgm of fentanyl at induction .At the end of surgery residual neuromuscular blockade was reversed with glycopyrolate 20 mic/kg and neostigmine 0.05mg/kg.Recovery time was recorded from cessation of the infusion or inhalational agent to eye opening on command , limb lift on command and achievement of Aldrete score >9.

### Results

: the achievement of the Aldrete score of  $\geq 9$  was achieved earlier in the study group than in the control group but the difference was not significant. It was also observed that there was initial fall in HR and SBP in the study group , and PONV and post operative pain was less in the study group. Conclusion : No significant difference was noticed in the achievement of Aldrete score of  $\geq 9$  in the two groups.

## INTRODUCTION

Since its introduction into clinical practice , propofol has acquired an important place in the anaesthesiologists armamentarium and the interest in the total intravenous anaesthesia has been revived by propofol . An ideal intravenous anaesthetic regime used in day care surgery should provide rapid recovery and early discharge with minimal side effects and should be cost effective . Propofol is the drug of choice when a rapid and smooth recovery is required . Recovery from propofol anaesthesia is characterized by the absence of “ hangover effect “ and a low incidence of nausea and vomiting (1). Rthe unique pharmacodynamic profile of propofol has greatly facilitated the use of TIVA techniques. In addition the use of TIVA avoids local and global pollution seen with inhalational

anaesthetic agents especially with Nitrous Oxide ( 2,3,4 ).

This randomized controlled study was designed to evaluate total intravenous anaesthesia ( TIVA) , as an anaesthetic technique for day care gynaecological procedures and to compare TIVA with conventional inhalational based technique in terms of intra and post operative hemodynamic profile , post operative recovery and undesirable sequelae like PONV.

## MATERIALS AND METHODS

One hundred twenty ASA grade I and grade II adult consenting patients in the age group of 20-45 yrs undergoing gynaecological laparoscopy or abdominal tubal ligation as elective day care surgeries were divided randomly into two

## **A Comparison of total intravenous anaesthesia ( TIVA ) to conventional general anaesthesia for day care surgery.**

groups of 60 patients each.

GROUP I included 60 patients and acted as control group .

This was the conventional inhalational based general anaesthesia group .

GROUP II included 60 patients and was study group , the total intravenous group.

No premedication was given in either group

In the control group, induction of anaesthesia was achieved with thiopentone Na 3-5mg/kg and maintenance with N<sub>2</sub>O/O<sub>2</sub>/isoflurane (0.2-0.6%) as judged clinically . Isoflurane was tapered at the end of surgery and stopped at skin closure . N<sub>2</sub>O was stopped at skin closure.

In the study ( TIVA) group patients were induced with propofol 2-2.5mg/kg and maintained on a continuous infusion of 3-12mg/kg/hr with air in 33%oxygen mixture. The rate of propofol infusion was adjusted according to need of anaesthesia depth . Propofol was tapered towards the end of case and stopped at skin closure .Both groups received 0.5mg/kg atracurium for intubation and further maintained on top up doses .Analgesia in both was provided with 2µgm of fentanyl at induction .

At the end of surgery residual neuromuscular blockade was reversed with glycopyrolate 20 µg/kg and neostigmine 0.05mg/kg.

Recovery time was recorded from cessation of the infusion or inhalational agent to eye opening on command , limb lift on command and achievement of Aldrete score >9.

### **Figure 1**

Parameter ACTIVITY	ALDRETE SCORE	Score
Moving all 4 extremities		2
Moving 2 extremities		1
Not able to move any extremity		0
<b>RESPIRATION</b>		
Able to deep breath and cough freely		2
Dyspnea, shallow or limited breathing		1
Apnoea		0
<b>CIRCULATION (SBP )</b>		
±20mmHg preanesthetic level		2
±20-50mmHg preanesthetic level		1
± >50mmHg preanaesthetic level		0
<b>LEVEL OF CONSCIOUS.</b>		
Alert		2
Drowsy, arousable on calling		1
No response		0
<b>COLOR</b>		
Normal		2
Pale or dusky		1
Cyanosis		0

### **RESULTS**

The patients in both the groups were comparable with respect to age and weight ( Table I).Mean heart rate and hemodynamic variables preoperatively was comparable ( Table II, III, ).In the intraoperative period there was a slight decrease in the heart rate from preoperative baseline levels in group II patients in first 10 min while no such decrease in the heart rate was observed in group I patients. The relationship was statistically insignificant. Similarly although mean heart rate in group II at various instances intra operatively was lower than in group I , the comparison was statistically insignificant ( Table II ) . Group two patients showed an initial fall in mean arterial blood pressure when compared to baseline values as well as group I , the difference was statistically insignificant . During the rest of intraoperative period the blood pressure remained lower than the preoperative levels in both the groups with a statistically non significant difference ( Table III).Recovery was assessed by times to eye opening to command and return to the limb movents on command . In the post operative period , the return of activity i.e time achieved to eye opening on command occurred at 17.8 ± 12.7min after termination of isoflurane in group I while in group II ( propofol group ) eye opening occurred at 12.6±11.2 minutes after termination of propofol infusion (Table IV). The return of limb movement on command occurred earlier in group II than in group I . The relationship of recovery characteristic was statistically significant when the two groups were compared( p- value) Table IV .The ability to breath deeply and to cough freely on command developed earlier in group Ii as compared to group

## A Comparison of total intravenous anaesthesia ( TIVA ) to conventional general anaesthesia for day care surgery.

I and the difference was statistically significant  $p < 0.05$  ( Table V ). In the post operatively period there was minimal change in mean systolic blood pressure in patients of group II as compared to group I with systolic blood pressure remaining nearly baseline in majority of patients . The achievement of an Aldrete score  $\geq 9$  occurred earlier in patients of group II ( 19min) as compared to group I ( 20min ) but the difference was not statistically significant when the two groups were compared (  $p > 0.05$ ). The patients of both the groups were assessed in the recovery area for level of consciousness at three levels ie alert, conscious but drowsy and arousable. In group I it was found that the level of consciousness was with most of the patients remaining in the conscious but drowsy state for most of the time of their stay in the recovery room . In group II patients, the patients were predominantly alert state within minutes of entry in the recovery room. the time to return of full consciousness in the patients of group II was about 12min as compared to 25 min in group I .

In the immediate post operative period the two groups were assessed for the development of postoperative nausea and vomiting (PONV) . Incidence of nausea and vomiting in group I was higher in group I with 27 patients (45%) developing PONV while in group II the incidence of PONV was 20% ( 12 patients ) . When the two groups were compared incidence was statistically significant with  $p$  – value of 0.001.

The mean postoperative pain score on visual analogue scale was 4.1 in group I and 3.1 in group II, the difference was not statistically significant(  $p > 0.05$ ).

### Figure 2

Table I showing demographic data

	Control group	Study group	p value
Mean Age (yrs)	31.93 ± 5.93	32.67 ± 5.07	>0.05
Mean Weight (kg)	53.5 ± 7.96	57.39 ± 8.11	0.095

### Figure 3

Table II showing mean heart rate at pre operative . intra operative and post operative periods in the two groups

Group	MEAN HEART RATE					
	Preoperative	10 min	20min	30 min	Termination	Post op
I	80	83	82	81	83	82
II	82	76	78	80	81	80

Table III showing mean arterial pressure ( SD ) during preoperative , intraoperative and post operative period

### Figure 4

Table III

Group	MEAN ARTERIAL PRESSURE						
	Pre induction	Post induction	10	20min	30 min	Termination	Post op
I	89±14	85±12	87±10	86±12	86±14	87±15	90±15
II	90±16	83±14	87±11	85±12	86±12	86±14	87±14

### Figure 5

Table IV showing mean time in achieving eye opening and limb movement on command in two groups

GROUP	I Conventional GA	II (TIVA)	P value
Eye opening (minutes)	17.8 ±12.7	12.6±11.2	0.024
Limb movement (minutes)	35.30±37.2	25.5±20.5	0.037

### Figure 6

Table (V) showing mean time in the two groups to breath and cough freely

GROUP	I (Isoflurane)	II (Propofol)	P - value
DEEP BREATHING (minutes)	7.5±5.3	5.2±6.4	.014
COUGH FREELY (minutes)	12.1±6.3	9.3±4.0	.003

## DISCUSSION

Intravenous anaesthetics have evolved from being used primarily for induction of anaesthesia to provide unconsciousness and amnesia for surgical procedures performed under general anaesthesia. New insights into the pharmacokinetic and dynamics of intravenous anaesthetic techniques, as well as development of computer technology to facilitate intravenous drug delivery , have greatly enhanced use of total intravenous anaesthetics.

Propofol is commonly used for induction of anaesthesia for day care surgery and is widely used as a component of TIVA (5) . Propofol has pharmacokinetic profile that favours its use as a continuous infusion for maintenance of general anaesthesia . TIVA with propofol has been shown to be superior to inhalational anaesthesia in operations of short durations in terms of rapid awakening and return to street fitness (3,6) . Many studies have demonstrated the advantages of TIVA with propofol for day care procedures. (7,9) . This randomized prospective study was designed to compare the hemodynamic and recovery benefits if TIVA using propofol and fentanyl with conventional inhalational anaesthesia in patients undergoing short gynaecological procedures.

Induction of anaesthesia with propofol was found to be

## **A Comparison of total intravenous anaesthesia ( TIVA ) to conventional general anaesthesia for day care surgery.**

---

associated with a slight drop in the heart rate and systolic blood pressure as compared to conventional inhalational , although it was statistically non significant. In the intraoperative period TIVA was associated with better hemodynamic stability than conventional general anaesthesia. Similar results were observed by R M Grounds et al 1985 (9) and Michael M Todd et al 1993 (10) . These studies confirm the safety of propofol during the intraoperative period for maintenance of anaesthesia in spite of hypotensive effects . The hypotensive effects of propofol appear to be transient in nature and are not of sufficient nature so as to compromise coronary circulation .(11).

The arterial oxygen saturation was monitored throughout the surgery using pulse oximetry. No evidence of desaturation was evident in any patient of either group . In the conventional general anaesthetic group, 4 patients developed drop of oxygen saturation to 85% and required oxygen supplementation in recovery room which was attributed to diffusion hypoxia due to use of nitrous oxide in the gas mixture during the maintenance of anaesthesia and also delayed recovery. These findings confirm that maintenance of anaesthesia during propofol with air or air /oxygen mixture is adequate for maintenance of SpO<sub>2</sub> within normal limits. Furthermore TIVA reduces the risk of development of diffusion hypoxia that can occur in patients maintained on N<sub>2</sub>O / O<sub>2</sub> mixture.

An assessment of post operative recovery by Aldrete scoring found that there was early recovery in patients who received TIVA as compared to conventional general anaesthesia although not statistically significant . The findings of other studies confirm our findings ( 6, 10 ) . Similar findings have been seen by other investigators who have used other scoring systems like Steward score by Marshall et al 1992 (12).

The time to eye opening , limb lift were earlier in the patients receiving TIVA as compared to General anaesthesia technique . Our findings supported by other authors demonstrate that TIVA was associated with improved early postoperative well being with better recovery.

In our study fewer patients (20%) in the propofol group experienced postoperative nausea and vomiting in the recovery ward as compared to conventional GA group (45%) . Klazima Vissa et al ,2002 (13) reported an incidence of postoperative nausea and vomiting of 47% after isoflurane and 29% after TIVA . Similar results were seen in studies of

Sneyd J R et al 1998 and C K Hofer et al , 2003 ( 14) . these findings conclusively prove superior emetic profile of TIVA despite the use of opioids over conventional anaesthetic technique and hence the better suitability of TIVA for use in out patient surgical procedures .

We conclude that TIVA is associated with better hemodynamic stability intraoperatively than conventional GA and that recovery is earlier and better than GA , with less postoperative nausea and vomiting . Due to better recovery profile of patients on TIVA , this technique is , therefore , better suited for day care surgery as it allows discharge of patients who are well oriented and are fully alert at the time of discharge with less complaints of PONV.

### **References**

1. Jan Van Hemelrijck and Paul F White  
Chapter 13 , pages 311-327
2. O Hare B, Fitz Patrick GJ : General Anaesthesia and Environment  
Ir Med Journal 1994 : 87(5) : 149-50
3. Wamman S, Guldager H, Rasmussen A M et al,  
Total intravenous Anaesthesia with Propofol : Is it necessary to supply N<sub>2</sub>O  
Ugeskr Laeger 1990; 152(34) : 2415-7
4. Arti S Inamdar, Radha A , Pagedar, Shekhar Y Bhojraj et al  
Comparisn of Total Intravenous Anaesthesia to Conventional Inhalational General Anaesthesia for spine surgery.  
J Anaesthesiology Clinical Pharmacology 2002; 18 (3) ; 256-261
5. A Gupta , M Kullunder , K Ekberg , C Lennmarker  
Assesment of Recovery following day case arthroscopy – A comparison between propofol and Isoflurane based anaesthesia .  
Anaesthesia 1995, volume 50, page 937-942
6. Philips AS , Mirakhur R K , Glen J B et al  
Total intravenous anaesthesia with propofol or inhalational anaesthesia with isoflurane for major abdominal surgery – Recovery characteristics and post operative oxygenation – an inhalational multicentric study  
Anaesthesia 1996 ; 51 : 1055-59
7. Price M L , Walmsley A , Swaine, et al  
Comparison of total intravenous anaesthetic technique using propofol infusion , with an inhalational technique using enflurane for day care surgery  
Anaesthesia 1988, 43 ( supp) ; 84-87
8. Steegers PA , Foster PA  
Propofol on total intravenous anaesthesia without nitrous oxide  
Anaesthesia 1988: 43 (supp) ; 94-7
9. R M Grounds , A J Twigley, F Carli, J G Whiteman , M Morgan  
The hemodynamic effects of intravenous induction ; comparison of the effects of thiopentone and propofol.  
10. Michael M Todd, David S Warner, Martin D , Sokoll, Mazga Maktabi, Bradley J  
A prospective trial of three anaesthetic for elective supratentorial craniotomy  
Anaesthesiology 1993; (8) 1005-1020

***A Comparison of total intravenous anaesthesia ( TIVA ) to conventional general anaesthesia for day care surgery.***

---

11. Raeder J C , Misvaer G et al  
Comparison of propofol induction with thiopentone or methohexitone in short outpatient general anaesthesia  
Acta anaesthesiology Scand 1988; 32 : 607-613.
12. Marshall CA , Jones Rm , Bajorek PK , Casahman J N  
Recovery characteristics using isoflurane or propofol for maintenance of anaesthesia-a double blind controlled trial.  
Anaesthesia 1992; 47 ; 461 – 466
13. Klassina Visssg , Elly A , Hassnik, Gouke J Bonsel, Cor J Kalkman  
Randomized controlled trial of total intravenous anesthesia with propofol versus inhalational anesthesia with isoflurane – nitrous oxide.  
Anesthesiology 2001; 95: 616 – 612
14. C.K.Hofer, A. Zollinger, S. Buchi, R. Klaghofer, D. Serafino, S. Buhlmann et al  
Patient well being after general anesthesia: a prospective, randomized, controlled multi centre trial comparing intravenous and inhalational anesthesia.  
Brit J Anes 2003;91: 631 – 7

**Author Information**

**Velayat Nabi Buchh, MD**

Senior Resident, Post Graduate Department Of Anaesthesia SKIMS , Soura ,Srinagar

**Basharat Saleem, MD**

Associate Professor, Post Graduate Department Of Anaesthesia SKIMS , Soura ,Srinagar

**Fayaz A Reshi, MD**

Lecturer, Post Graduate Department Of Anaesthesia SKIMS , Soura ,Srinagar

**AM Hashia, MD**

Professor and Head, Post Graduate Department Of Anaesthesia SKIMS , Soura ,Srinagar

**Showkat Gurcoo, MD**

Additional Professor, Post Graduate Department Of Anaesthesia SKIMS , Soura ,Srinagar

**Asaf Nazir Shora**

Senior Resident, Post Graduate Department Of Anaesthesia SKIMS , Soura ,Srinagar

**Shigufta Qazi, MD**

Professor and Head, Post Graduate Department Of Anaesthesia SKIMS , Soura ,Srinagar