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A Comparative study of Total Intravenous Anaesthesia using Propofol and Fentanyl with Standard Balanced Anaesthesia Technique using Isoflurane in Short Stay Surgical Procedures

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Abstract

Background: In most procedures, total intravenous anaesthesia (TIVA) and balanced anaesthesia are employed. The goal of our study was to assess the recovery features, haemodynamic alterations, and any adverse effects in day care procedures across two groups: TIVA using propofol + fentanyl and Balanced anaesthesia using propofol and isoflurane.

Material and methods: This randomized study was undertaken on sixty ASA grade I and II patients of 20 -60 years age, of either sex, weighing 40 -70 kg , divided into two groups of thirty each.

Group I patients were induced with propofol 2.5 mg/kg plus fentanyl 3 µ gm/kg. The airway was maintained with 100% oxygen by facemask with continuous propofolinfusion

Group II Induction was done with propofol 2.5 mg/kg and fentanyl 3 µgm/kg. Intubation was done with Suxamethonium 1.5 mg/kg. I.V. Anaesthesia was maintained on Isoflurane 1% and nitrous oxide:oxygen: 70:30.Injection Vecuronium 0.05 mg/kg was used for muscle relaxation.

Results:

Modified PADSS score≥9 was achieved in both groups at 1 hour (P=.129).The patients in Group I had smooth recovery with no history of cough or postoperative nausea vomiting. Therefore, TIVA is better choice of anaesthesia in Day care surgeries.The patients in group I were haemodynamically more stable at 0 min, 5 min, 40 min, and 50 min after induction($P<0.05$)

Conclusion: TIVA is a better choice as compared to balanced anaesthesia with Isoflurane in day care surgeries.

Key Words: Propofol, Balanced anaesthesia, TIVA, Isoflurane, Day care surgery.

Introduction

Short-acting intravenous (IV) anesthetics have been increasingly used in general anesthesia (GA) to overcome the disadvantages of inhalational anesthetics such as postoperative nausea and vomiting (PONV) and air pollution in the operating room. Typically, propofol and remifentanil are the preferred anesthetic agents for total IV anesthesia (TIVA) or balanced anesthesia (BA) due to their favorable pharmacological properties. There are several advantages of using propofol, which includes rapid onset and offset with fewer side effects such as PONV, due to which it is considered as an important drug that plays a key role in TIVA. Remifentanil is an ultra-short-acting synthetic

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opioid and is frequently selected as an adjuvant for TIVA with propofol or BA to aid the inhalational anesthetic agents. However, several studies have previously reported opioid-induced hyperalgesia (OIH) and/or acute tolerance after intraoperative use of remifentanil.Significant concerns might be required in the management of postoperative pain after surgery with remifentanil-based anesthesia.

Propofol has been the preferred drug for complete intravenous anaesthesia since the mid-1980s, owing to its excellent recovery quality. Vuyk et al[1] investigated the use of propofol and opioids in combination in 1977. Ralph Waters[2] established a contemporary ambulatory unit in the early 1900s. Outpatient surgery has increased at an exponential rate during the last few decades. Day surgery has a number of advantages, including lower hospital costs, less inconvenience for patients, more patient satisfaction, less post-operative problems, and quicker return to work. Because hypoxic pulmonary vasoconstriction is avoided in TIVA, it is beneficial in patients with a history of malignant hyperpyrexia, bronchoscopy, and thoracic surgery. The "Greenhouse Gas" nitrous oxide is a substantial contributor[3,4]. Nitrous oxide and halogenated volatile anaesthetics cause considerable environmental impact, such as ozone layer depletion. Nitrous oxide interacts with oxygen to form nitric oxide, which has a 150-year atmospheric lifespan and impacts the ozone layer.Isoflurane can undergo photolysis in upper atmosphere,with the release of free chlorine atoms.Free chlorine atoms act as catalysts for ozonedestruction.

Material And Methods

After taking approval from the institutional ethics committee, sixty ASA grade I and II patients of either sex,between 20 to 60 years, weighing between 40-70 kg,undergoing elective surgeries of duration less than 1 hour were included in our study.We divided them into twogroups:

Group I - TIVA with propofol.

Group II - Standard Balanced Anaesthesia.

Patients having history of obstructive lung disease, asthma, recent myocardial infarction, hepatic or renal disease, psychiatric disease, uncontrolled hypertension and patients on chronic use of opioids or benzodiazepines wereexcluded.All patients were pre-medicated with tablet alprazolam 0.5 mg orally at bedtime and were kept fasting thereafter. After shifting the patient into operating room, non-invasive blood pressure (NIBP), ECG, pulse oximeter monitors were connected. Peripheral intravenous access was started using 18 Gauge I.V. cannula. The patients were then randomly divided into two groups using random allocation software.

Group I (TIVA with Propofol): After recording the pulse, NIBP and SpO_2, continuous I.V. infusion of normal saline was given. Through the second I.V. line, injection Fentanyl 3µg/kg, two minutes prior to induction was given over 30-60 seconds and was repeated 25µg every fifteen minutes. Anaesthesia was induced with propofol 2.5mg/kg (40mg every ten seconds). The airway was maintained by a facemask, while the patient breathed 100% oxygen. Anaesthesia was maintained by continuous infusion of propofol 10mg/kg per hour for ten minutes, followed by 8mg /kg per hour for next ten minutes and continued at 6mg/kg per hour thereafter. At the end of the procedure, intramuscular injection of diclofenac sodium 75mg wasgiven.

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Group II (Standard Balanced Anaesthesia): after recordingthe pulse, NIBP and SpO_2, continuous I.V. infusion of normal saline was given. Injection Fentanyl 3 µg/kg two minutes prior to induction was given over 30-60 seconds and repeated 25µg every fifteen minutes. Anaesthesia was induced with Propofol 2.5mg/kg (40mg every ten seconds) until loss of response to verbal command. Injection Suxamethonium 1.5mg/kg I.V was given, followed by laryngoscopy and intubation. The patient was connected to anaesthesia machine with a mixture of Nitrous Oxide:Oxygen::70:30 along with 1% Isoflurane for ten minutes and 0.6 % thereafter (using Bain's circuit). Injection Vecuronium 0.05mg/kg was used for muscle relaxation. At the end of the procedure, injection of diclofenac sodium 75mg wasgiven**.**

Intraoperative stresses i.e. Systolic BP>15mmHg above preoperative baseline for at least one minute or Tachycardia (heart rate>90 beats per minute for at least one minute) was treated with an incremental fentanyl 50 µg I.V. When the patient showed movement during surgery, we supplemented 20-40 mg propofol as I.V. bolus. Hypotension (less than 30% of base line) was treated by I.V. fluids or by reduction in propofol infusion. Bradycardia (heart rate <40beats per minute for at least one minute) was treated with an anticholinergic agent. At the end of the procedure, Propofol or Isoflurane was stopped. Neuromuscular block was reversed with neostigmine 0.04mg/kg and Atropine 0.02mg/kg in Group II patients. The patients were shifted to recovery room after adequate reversal. In the recovery room, the time at which the patients scored an Aldrete score of nine was noted, and this was taken as a time which was used as an index of fitness to leave a primary recovery area. Once the patient achieved Modified PADSS Score of ≥9 points, patient was considered fit for discharge. Patients were asked if they remembered anything during surgery. Serious adverse events were also recorded. Patients' characteristics were compared using t-tests and chi squaredtests.

Observations and Results

The demographic data(*Table 1*)was comparable in both the groups.Recovery occurred earlier in Group II (Isoflurane) with eye opening on command, after cessation of the anaesthetic, at a mean durationof 4.26 minutes

Table 1: Demographic data

Parameters	**TIVA Group**	**Balanced Anaesthesia Group**
Age (yrs.)	*43.33 ± 12.13*	*41.73± 12.58*
Weight (kg)	*56.53 ± 9.23*	*57.86 ± 8.7*
Sex [M: F ratio]	*17:13*	*19:11*
Duration of surgery(minutes)	*26.40 ± 13.74*	*27.10 ± 9.97*

Table 2: RecoveryCharacteristics

Parameters Group	**TIVA Group**	**Balanced Anaesthesia**	**P value**
Time to eye Opening (minutes)	*6.66 ± 2.79*	*4.26 ± 2.55*	*0.001*
Time to achieve Aldrete score≥9	*8.13 ±3.03*	*5.10± 3.13*	

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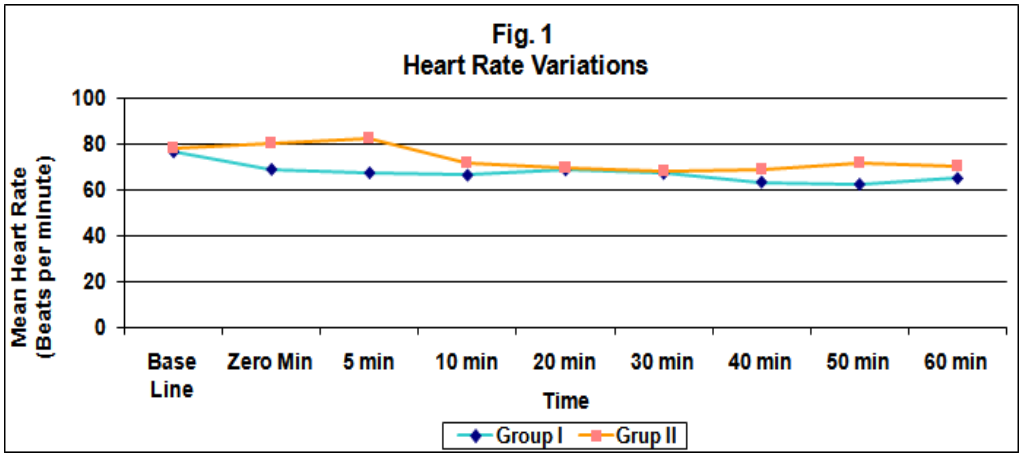
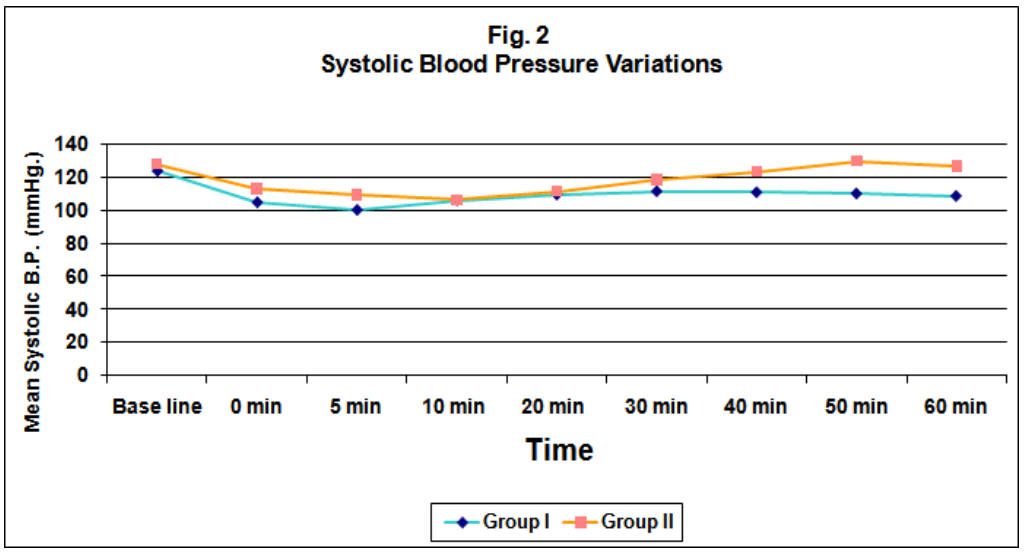
Modified PADSS score achieved at 1 hour	*9.70± 0.46*	*9.87±0.33*

Table3: Side Effects

Side Effects	***TIVAGroup n=30***	**Balanced Anaesthesia Group *n=30***
Intra-operative Apnoea Bradycardia HR <50	 *15* *4*	 None None
Post- operative *Cough* *Nausea& Vomiting*	 None None	 *3* *6*

Haemodynamic Characteristics





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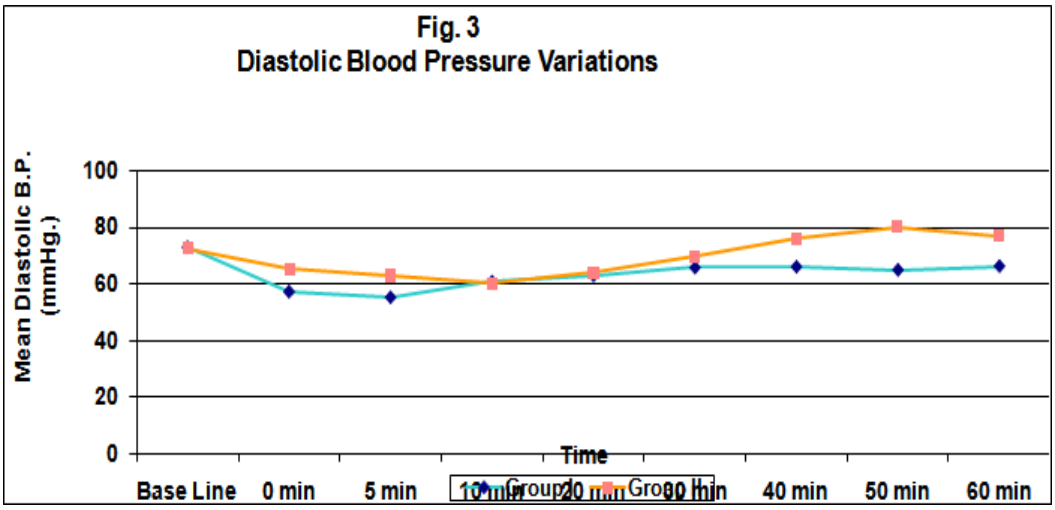

Eye opening and Aldrete score more than 9was earlier in Group II[isoflurane group]and was 4.2min and 5.10 min versus6.6 min and 8.13 min in TIVA group (p≤.001). Home readiness in terms of PADSS score ≥9 achieved in both groups at 1 hour(P=.129). Cough and nausea vomiting were less in TIVAgroup.

The patients in group I were haemodynamically more stable at 0 min, 5 min, 40 min, and 50 min after induction(P<0.05)

Discussion

Patients, workers, and the community all benefit from day surgery. Both inhalational and complete intravenous anaesthesia procedures can result in a rapid return to post-anaesthetic street fitness and a high level of patient satisfaction. The purpose of this study was to examine the recovery characteristics and haemodynamic alterations in day care surgery between the TIVA and Balanced Anaesthesia groups.

Our study was in accordance with Rowbotham et al.[5]Time to eye opening was 6.6 minutes in group I and4.2 minutes in group II (p=.001).Time to achieve Aldrete score≥9 was 8.13 minutes in TIVA comparable(p=0.129)

Nightingale and Lewis[6] observed early recovery in 7.9 minutes in TIVA and 9.6 min in Isoflurane.

Dragana et al. [7]observed eye opening on command at 9 min in Isoflurane group and 11.5 min in TIVA group. Duration of surgery was longer i.e. 65 -69 min. Spontaneous breathing occurred at 6.2 min in Iso group and 8.5 min in propofol group.

Todd et al.[8]hadspontaneous eye opening at 10 min in both isoflurane group and TIVA group. This was higher than in our study as they had used higher doses of fentanyl (10 µg/kg) and propofol,and had taken patients undergoing craniotomy.

Our study was similar to Fish et al.[9] who used Sevoflurane and TIVA with propofol and 6 minutes in TIVA group.Aldrete score ≥9 was achieved at 10 minutes in Sevoflurane group and 8 minutes in TIVA group.PADSS score >9 was achieved at 26 minutes in Sevoflurane group and28 minutes in TIVA;whereas our PADSS score recorded at 1 hour was >9.

Russel et al.[10] in their study observed 5-7 minutes apnoea in 37 % of his patients requiring IPPR in manual group.We also observed apnoea in 15 patients (50 %) and they had to be ventilated just after induction. The difference in apnoea could beexplained as they had used less dose of Fentanyl(1.5µg/kg) and Propofol (6 mg/kg/hour infusion).

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Smith et al (1999)[11] observed apnoea in 84 % patients on induction in TIVA group.
Djaiani et al[12] studied propofol auto-co–inductionfor ambulatory surgery.All patients received 10µg/kg Alfentanyl followed 2 min later by Propofol 0.4mg/kg. Propofol infusion at the rate of 50mg/kg/hr was initiated and Laryngeal mask airway was inserted. Maximum heart rate reduction was 15%from baseline. In our study, maximum reductionin mean heart rate was12.98.

Russel et al. compared manual with target-controlled infusion of propofol and noted3.8 % increase in mean heart rate in manual group at 0 min. thereafter 12.98%fall in mean heart rate at 5 min and 11.68%fall at 10 min. In our study, mean heart rate decreased by 10.38% from baseline at 0 min and 11.68% at 5 min and 12.98%at 10 min.The decrease in mean heart rate is comparable in both studies ,while 3.8% increase in heart rate was due to LMA insertion in the study done by Russel. In our study TIVA group was on spontaneous ventilation.

In the study done by Rowbotham, fall inmean systolic B.P. was seen 6.7% at 0 min and 25.3% at 5 min.In our study, mean systolic B.P decreased by 15.3% from baseline at 0 min and 19.35% from baseline at 5 min .Less fall in Rowbotham study at 0 min was due to intubation response.

Conclusion

We concluded that TIVA group although had slightly delayed achievement of Aldrete score ≥9 in 8.13 minutes, versus5.10 minutes in Isoflurane group, but the patients had better clear head recovery with no recall , cough, nausea-vomiting.PADSS scorewas same in both the groups.Hence, we strongly recommend the use of TIVA in day care surgeries.

Limitation of study: Number of patients was small,we did not examine the environmental exhaust/pollution,intraoperativeBIS or entropy was not used.This could have resulted in slightly more incremental drug used.During induction there was apnoea in 50 % patients of group I and they had to be manually ventilated by mask for few minutes.Supraglotticdevices were not used

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