

A Comparison between Total Intravenous Anesthesia (TIVA) and Conventional General Anesthesia in Day Case Surgical Procedures

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ABSTRACT:

BACKGROUND:

Day case surgery should be of short duration, rapid recovery, and with low incidence of postoperative complications. For long time was done with conventional inhalational based anesthesia, in last year's, TIVA began to be used in these surgeries.

OBJECTIVE:

To evaluate total intravenous anesthesia (TIVA), as an aesthetic technique for day case procedures and to compare it with conventional inhalational based technique in terms of intra and postoperative hemodynamic and respiratory changes, postoperative recovery and postoperative vomiting.

PATIENTS AND METHODS:

This is a prospective randomized study has been done on 100 patient who underwent general anesthesia for short duration surgical procedure in AL- Jumhory teaching hospital in Al-Mosul city in Iraq, during the period between Nov 1st, 2011 and March 1st, 2012 , All patients were allocated into either TIVA or inhalational (INH) groups, of 50 patient each. In TIVA group: induction and maintenance of anesthesia done by propofol. While in INH group: maintenance of anesthesia done by halothane. Blood pressure, pulse rate, respiratory rate were monitored at a specific time. Recovery time was recorded according to Aldrete score. Any episode of vomiting was recorded.

RESULTS:

Aldrete score of ≥ 9 was achieved earlier in the TIVA group than in the INH group. It was also observed that there was initial fall in HR, MAP and respiratory rate in the both group, and post operative vomiting was less in the TIVA group.

CONCLUSION:

The time needed for recovery and episodes of postoperative vomiting in TIVA is less than in inhalational anesthesia.

KEYWORDS: TIVA, propofol, day case surgery.

INTRODUCTION:

A surgical day case is defined by the Royal College of Surgeons of England as "a patient who is admitted for investigation or operation on a planned non-resident basis and who nonetheless requires facilities for recovery".⁽¹⁾ During recent years duration of hospital stay has been reduced. Currently approximately 50% of elective operations are performed as day cases⁽²⁾. Principles of anesthesia are the same as for in-patient care, requires high quality induction, maintenance and recovery. The recovery should be free from side effects.⁽³⁾ Prior to discharge from the day case unit patients should have stable vital signs, alert and orientated, comfortable, pain free, able to walk, able to tolerate oral fluids, and have minimal

nausea and vomiting.⁽³⁾

The use of continuous infusion techniques has considerable practical advantages, including minimal cardiovascular depression, rapid recovery and the avoidance of hazards of exposure to inhalational agents.⁽⁴⁾ The development of TIVA and present interest in it, owes much to a number of important studies.⁽⁵⁾ In the lookout for an ideal intravenous anesthetic agent in clinical practice, Kay and Rolly introduced propofol in 1977.⁽⁶⁾

Recovery from propofol anesthesia is characterized by the absence of "hangover effect" and a low incidence of nausea and vomiting.⁽⁷⁾

Lack of analgesic properties of propofol has necessitated the need for supplementary analgesic agents during TIVA.⁽⁸⁾

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Fentanyl is used extensively in TIVA now a day. It provides hemodynamic stability and lesser respiratory depression.⁽⁹⁾

Many anesthetics now include a combination of hypnotics (e.g., propofol) and analgesics (e.g., fentanyl).⁽¹⁰⁾ The hypnotic creates a loss of consciousness and lack of recall, and the opioids obtunds the reflex response to noxious stimuli.

⁽¹¹⁾ Furthermore, combining these two drugs creates a synergistic interaction, allowing clinicians to markedly reduce the amount of either drug required and to limit their individual side effects and accumulation in the body.⁽¹²⁾

Neuromuscular blockade is induced during controlled ventilation with oxygen enriched air.⁽⁴⁾

PATIENT AND METHOD:

This is a prospective randomized study has been done on 100 patient who underwent general anesthesia for short duration surgical procedure in AL- Jumhory teaching hospital in Al-Mosul city in Iraq, during the period between Nov 1st, 2011 and March 1st, 2012 , All patients were allocated into either TIVA or inhalational (INH) groups, of 50 patient each. All patients were of ASA I physical status, either gender, and their ages between 20-45 years. Any surgery expected to last more than 30 minutes, pregnant patient , or patient with history of allergy to egg or any drugs used in this study were excluded from this study

Standard anesthetic technique was used in all patients, essential monitoring were maintained which include ECG, SpO₂, noninvasive blood pressure and respiratory rate. Baseline parameters were observed and recorded.

TIVA Group: Received 1 mcg / kg fentanyl, additional dose of 0.5 mcg /kg was given to the patient if needed (Spontaneous movements during induction and hemodynamic variability were the indicators for the depth of the anesthesia). The anesthetizing bolus dose of propofol of 1.5 to 2.5 mg / kg were given, followed by the maintenance of continuous infusion of propofol by using syringe pump in starting dose of 10 mg /kg /hour , then tapered gradually and accordingly, and stopped at skin closure.

INH group: Received 1 mcg / kg fentanyl (additional dose of 0.5 mcg /kg was given to the patient if needed) and anesthetizing bolus thiopentone in a dose of 3 – 5 mg/kg and a high MAC (minimal alveolar concentration) of halothane (2-3 MAC) to ensure the good anesthetic depth . Then the halothane is decreased to (1 -1.5 MAC) to maintain the anesthesia and stopped at skin closure.

A laryngeal mask for both group were in sited to maintain the airways, and the patients were kept spontaneously breathing with 100% oxygen.

Non invasive blood pressure, pulse rate, respiratory rate and oxygen saturation were observed continuously and the first three parameters recorded at an interval of (1) minute for the first (5) minutes, and then in five minute interval.

After skin closure at the end of the surgery, the LMA were extubated under deep anesthesia.

The recovery from the anesthesia was confirmed according to Aldrete score. The color of the patient, blood pressure, pulse rate, and respiration were observed. The time from the end of surgery to the eye opening in response to verbal command and also to limb movement in response to command were recorded. Then the patients were asked about their name, date, and place of operation, if the patient could not answer the first trial completely, the next trial was performed after (1min) interval. Any episode of vomiting was recorded during the recovery.

Standard statistical methods used to determine the mean and prevalence by the use of the Statistical Package for Social Sciences (SPSS) system. P value of <0.05 was considered to be statistically significant and <0.01 was considered to be highly statistically significant.

RESULT:

The mean and standard deviation of the heart rate data for both groups are in the figure (1). Statistical analysis of data revealed that there was only slight, statistically not significant difference in heart rate parameters between the two groups.

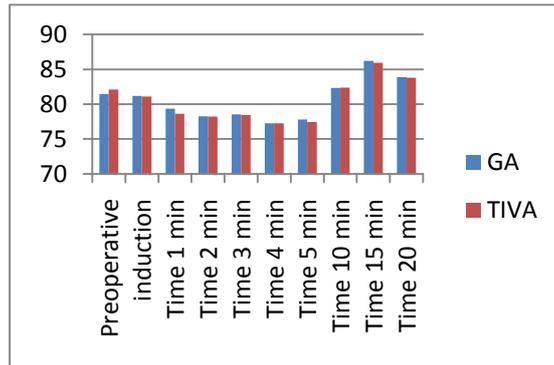


Figure 1: Heart rate histogram

The mean and standard deviation of the respiratory rate data for both groups are in the figure (2). Statistical analysis of data revealed that there were only slight, statistically not significant differences in respiratory rate parameters between the two groups.

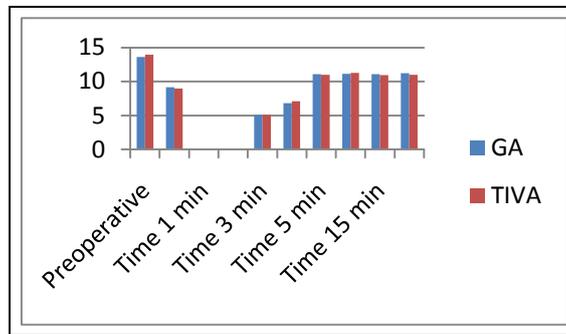


Figure 2 : Respiratory rate histogram

The mean and standard deviation of the mean blood pressure data for both groups are in the figure (3). Statistical analysis of data revealed that there were only slight, statistically not significant differences in mean blood pressure parameters between the two groups.

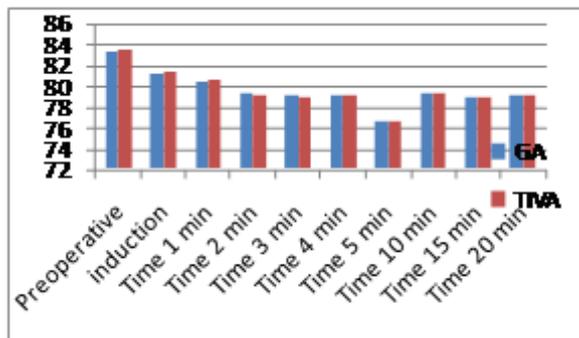


Figure 3: Mean blood pressure histogram

The incidence of post operative vomiting in TIVA group was lower than inhalational group, which is shown in figure (4)

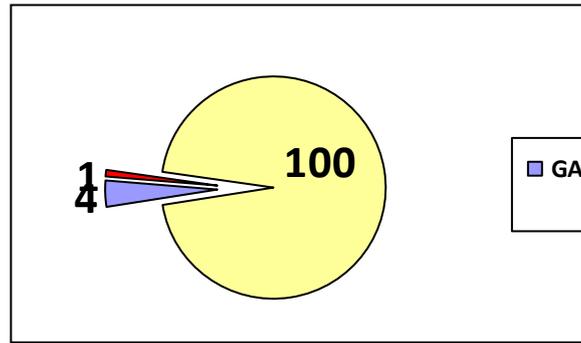


Figure 4: Pie chart represented the number of patient that exhibit an incidence of vomiting.

The mean and standard deviation of the recovery time data for both groups are in the tables (1). Statistical analysis of data revealed that the recovery time was faster in TIVA group, The time needed for eye opening and limb movement

to the verbal command were shorter in TIVA group than those of inhalational anesthesia group , there was a high significant difference (p value < 0.01)

Table 1: Recovery time (min.).

Recovery time(min.)	Type of Anesthesia	Mean ± SD	t	P	Significance
Eye opening	GA	8.28 ± 1.27	2.78	0.006	S**
	TIVA	7.4 ± 1.82			
Limb movement	GA	10.96 ± 1.82	2.70	0.008	S**
	TIVA	9.96 ± 1.87			

** : highly significance

DISCUSSION:

This study has major objective, to determine the perioperative adverse events that presented as the hemodynamic and respiratory changes and to compare between the time of recovery and incidence of postoperative vomiting.

As far as the hemodynamic parameters are concerned, there was a significant decrease in HR after induction.

❖ The decrease in heart rate with both groups can be explained on the basis of :-

- Fentanyl was given in a total dose of (1-2 µg/kg) during the anesthesia. This is an agreement with the study donen by Nielsen PF *et al.* ,1992⁽¹³⁾ and Mi WD *et al.* ,1998⁽¹⁴⁾.
- The high induction dose and infusion rate of propofol intraoperatively in TIVA group, with its myocardial depression effect or due to a marked drop in preload may lead to a vagally mediated reflex bradycardia⁽¹⁵⁾
- The high concentration of halothane which have a negative chronotropic effect to ensure the anesthetic depth in INH group.⁽¹⁵⁾

As the propofol possesses only hypnotic properties and additional analgesia is

necessary, fentanyl was a satisfactory agent in this respect.

❖ A direct effect of propofol on vascular smooth muscle in addition to myocardial depression and (inhibition of sympathetic vasoconstrictor activity) has been proposed to explain the reduction in arterial pressure associated with the induction of anesthesia⁽¹⁶⁻¹⁷⁾

Halothane also decreases blood pressure by myocardial depression and by direct action on smooth muscle of blood vessels as well as decreased central sympathetic tone.⁽¹⁸⁾

❖ The lower respiratory rate (for 2 minutes after induction) with each group was due to central respiratory depressant effect of fentanyl.⁽¹⁹⁾

Also propofol is a respiratory depressant , propofol infusion inhibits hypoxic ventilatory drive and depresses the normal response to hypercarbia⁽¹⁵⁾ and thiopentone which decreases tidal volume and increases frequency initially but at higher dose frequency also decreases causing significant decrease in minute volume.

❖ Better wakefulness score in TIVA group may be due to shorter duration of action of propofol as compared to inhalational group was definitely due to :

- Rapid hepatic and extra hepatic metabolism of propofol.
- The high clearance rate of propofol (10 times that of thiopental)⁽¹⁵⁾
- Compared with halothane which has a high blood- gas partition coefficient of halothane (2.4) which render it as high soluble volatile anesthetic and delay recovery.⁽¹⁵⁾

The lower incidence of developing a postoperative vomiting in TIVA group when compared with the INH group which had showed a greater incidence of postoperative vomiting, is due to the antagonism of dopamine D2 receptors by propofol in TIVA group, which has previously been suggested as a possible mechanism of this effect⁽²⁰⁾

CONCLUSION:

Both TIVA and inhalational groups are associated with the same hemodynamic and respiratory stability perioperatively. The recovery in TIVA is earlier and better than inhalational anesthesia. The postoperative vomiting was less in TIVA group.

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