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Comparative study between inhalational and total intravenous anaesthesia

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Abstract
The aim of the study was to investigate the effects of two anesthetic techniques (total intravenous technique vs. inhalational technique) on changes in pro- and anti-inflammatory cytokine levels during open cholecystectomy. The present study consisted of 60 patients of both sex between the age group of 18-60 yrs belonging to ASA physical status I & II, who were scheduled for short surgical procedures. The proposed study was carried out as a prospective clinical trial in patients at the Department of Anaesthesia, Krishna Institute of Medical Sciences, Karad, Maharashtra, after getting approval from Ethical Committee. Sevoflurane produces rapid induction compared to Propofol, when used in higher concentration. Hemodynamic stability is better with Sevoflurane when compared to Propofol.

Keywords: anaesthesia, inhalational, intravenous, propofol, sevoflurane

Introduction
The availability of rapid and short acting sedative-hypnotics (e.g. propofol), analgesics (e.g. fentanyl) has refocused the anaesthetists attention on the complete provision of anaesthesia by the intravenous route: Total Intravenous Anaesthesia (TIVA) [1]. The introduction of rapidly acting barbiturates in 1934 strengthened the concept of TIVA. However their kinetics did not render the drugs as ideal for use for the maintainance of anaesthesia. The introduction of propofol in 1977 added impetus to the goal of TIVA. Propofol with its attractive pharmacokinetics properties like titrable level of anaesthesia, rapid recovery and minimal side effects is an ideal agent for continuous infusion anaesthesia [2]. Suffice to say that continuous infusion anaesthesia with its potential advantages of rapid onset and recovery, minimal cardio respiratory side effects and absence of environmental pollution has an important role to play in the armamentarium of the anaesthesist in the years to come and might one day replace volatile agents for the maintenance of anaesthesia. In this study we objectively examine the arguments for and against inhalational and TIVA and look at where both of these techniques could be better adopted in day care surgeries. This study was designed to study and compare propofol the latest intravenous anaesthetic agent available with one of the very commonly used volatile agent, sevoflurane for the induction and maintenance of anaesthesia for short surgical procedures.

Aims and objectives
To decide a better anaesthetic technique for day care surgeries to compare the induction properties of two techniques. To compare intraoperative cardiorespiratory status of patients between two techniques. To assess the post-operative incidence of adverse effects (nausea, vomiting, pain). To compare the two techniques on the basis of post-operative recovery.

Review of Literature
Goodwin conducted a study comparing induction with sevoflurane 8% & 12% in adults and observed that both 8% & 12% induction provided stable cardiovascular profile with no increase in respiratory complications. Time of loss of eyelash reflex was not significantly different between two concentrations of sevoflurane [3]. Shao G, Zhan G did a comparative study of propofol with sevoflurane 8% with vital capacity breath and tidal volume breath for laryngeal mask airway insertion in elderly patients and noted that LMA was inserted most rapidly with propofol (89+_28sec) and least using tidal volume breaths (205+_44sec). With vital capacity breaths (163+_34sec) and concluded that induction with sevoflurane 8% using tidal volume breath technique provides smoother induction with a stable haemodynamic profile, less apnoea and technical demand but requiring longer time for LMA insertion in unpremeditated elderly patients [4]. Ravikumar Koppula and Anitha Shenoy did a comparative study by comparing quality and ease of insertion of laryngeal mask airway following induction of anaesthesia with either inhaled sevoflurane 8% or propofol 2.5mg/kg along with inj. Fentanyl 2µg/kg. They found that verbal contact and eyelash reflex lost faster with sevoflurane but took similar times to jaw relaxation and concluded that clinical conditions for laryngeal mask insertion were equally good with both induction techniques [5].
Propofol is now widely used in clinical practice because of its favorable recovery profile and low incidence of side effects. 1% propofol contains 10% soya bean oil, 2.25% glycerol, 1.2% purifed egg phosphide. Propofol is available as 1% solution in 10ml, 20ml, 50ml & 100ml vial. 2% solution is also available in Europe. In addition, 50ml pre-filled syringes of 1% & 2% solution are available[6]. Propofol inhibits acetyl choline release in hippocampus and prefrontal cortex through acting on GABA a receptors producing sedation. Propofol

Produces central nervous system effects by inhibiting NMDA sub- type of glutamate receptor through modulation of sodium channel gating [7]. At sub hypnotic doses, propofol provides sedation and amnesia. Propofol alters mood after short surgical procedures. It also produces general state of well-being.

Propofol produces cortical EEG changes ranging from initial increase in alpha to gamma and theta frequency. It also produces burst suppression at higher doses. It also produces a decrease in early component of somato sensory and motor evoked potentials but not an early auditory evoked potential. At subhypnotic doses, propofol relieves cholestatic pruritus and treating pruritus induced by spinal opiates. Propofol decreases polymorphonuclear leukocyte chemotaxis. Propofol inhibits phagocytosis and killing of staphylococcus aureus and E.coli.

Sevoflurane is first synthesized in late 1960's at Baxter - Travenol laboratory by R Frullie and coworkers. The first published record of human use in 1981, when results of phase I trial of the drug in six healthy adults were published. Due to drawbacks Baxter - Travenol decided not to develop commercially. It contracted with Japan firm, Maruishi Pharmaceuticals (Osaka) and following further research approved for clinical use in Japan in 1990. Its success in Japan was subsequently followed by its introduction into practice in USA and Europe [8].

Inhalational induction using sevoflurane is rapid (1 to 2 mins), smooth and well tolerated in both children and adults. Sevoflurane is poorly soluble in blood, pleasant smelling and fairly nonirritant to the upper airways. It therefore has a place as an induction agent. Various techniques have been used with success, either increasing the inspired concentration rapidly from 0.5% upto 4 to 8% by taking a single vital capacity breathe of 4.5% or higher, or by immediately breathing a high concentration 8%. Incidence of coughing is extremely low[9].

Materials and Methods

The proposed study was carried out as a clinical comparative study in patients at the Department of Anaesthesia, Krishna Institute of Medical Sciences, Karad, Maharashtra, after getting approval from Ethical Committee. This study was conducted from October 2011 to October 2013. This study was done after ethical committee approval and written informed consent obtained from all the patients included in this study.

Observation and Results

Sixty adult patients of ASA I and II between the age group of 18 – 60years of either sex for short surgical procedure were selected for the study. They were randomly divided into two groups group P and group S of 30 patients each. Group P denotes patients who received propofol and group S denotes patients who received sevoflurane. Induction time is measured in minutes, after starting the anaesthetic until the loss of eyelash reflex. Pre induction and intraoperative heart rate, mean arterial pressure and spo2 were recorded. Post operatively spontaneous eye opening and verbal response time was noted in minutes.

Table 1: Induction Time in Both Groups

	Propofol	Sevoflurane
Mean	38.9666667	31.96666667
Variance	59.9643678	131.6885057
Observations	30	30
p value	0.00390516	

As shown in table no. 1 induction time is significantly less in Group Sevoflurane patients (31.96±11.4) when compared with Group Propofol patients (38.96±7.74), (p=0.0078).

Table 2: Heart Rate Variation

Heart Rate	Sevoflurane	Propofol
0 min	86.3	84.1
5 min	87.7	83.2
10 min	89.8	81
15 min	88.9	79.1

In table 2, there was significant difference in heart rate variation during surgery in both the groups ($p<0.05$).

Table 3: Mean Arterial Pressure Variation

MAP	Sevoflurane	Propofol
0 min	96.8	96.6
5 min	93.1	87.4
10 min	89	83.3
15 min	86.7	83.4

As shown in table 3, the reduction in mean arterial pressure in propofol group was more as compared to sevoflurane group but the difference was not statistically significant ($p>0.05$).

Discussion

Gas induction in adults had largely fallen into disuse because intravenous induction proved rapid, reliable and smooth induction. Propofol is a common intravenous anaesthetic agent used for TIVA in short surgical procedures. Sevoflurane is suitable for inhalational induction technique even in high concentrations because of its low blood gas solubility and minimal respiratory irritant effect. We obtained a faster induction time with sevoflurane as compared to propofol in contrast to some previous studies of Neerja Bharti et al[10] and Jellish WS et al[11]. This could be because we had used a vital capacity induction technique with 8% sevoflurane in oxygen instead of a tidal induction technique or with increasing concentration of sevoflurane. Also we gave induction dose of propofol over 30 seconds. Our study correlate with the findings of Philip BK at et all who also used vital capacity induction for sevoflurane and obtained a shorter induction time than propofol. Since both sevoflurane and propofol reduces systemic vascular resistance (SVR), it is not surprising that MAP values were not significantly different between two groups. However MAP was lower in propofol group than sevoflurane group, the difference is not statistically significant. Previous investigators also have shown a decrease in MAP after induction of anaesthesia with propofol than with sevoflurane [11-13]. However sevoflurane group had a higher heart rate than propofol group. The increase in heart rate

Become evident after 5 minutes of induction of anaesthesia. The recovery was not different in two groups. Patients in propofol group were awake faster than in sevoflurane group, although patients in sevoflurane group were induced faster than those in propofol group.

Conclusion

The present study it can be concluded that sevoflurane produces rapid induction compared to Propofol, when used in higher concentration (8% in 8 liters/min flow rate). Hemodynamic stability is better with Sevoflurane when compared to Propofol. Post-operative recovery time is similar in both the techniques.

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