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EMERGENCE FROM ANESTHESIA IN CHILDREN UNDERGOING AMBULATORY SURGERY- A COMPARISON BETWEEN PROPOFOL AND SEVOFLURANE USING SINGLE ANESTHETIC TECHNIQUE

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ABSTRACT

Objective: To compare emergence from anesthesia using total intravenous anesthesia (TIVA) with propofol and volatile induction maintenance anesthesia (VIMA) with sevoflurane, in children undergoing ambulatory inguinal herniorrhaphy.

Study Design: Randomized, controlled trials.

Place and Duration of Study: Shifa Hospital of Pakistan Navy, from 1st Mar 2005 to 28th Feb 2006.

Patients and Methods: Eighty children, aged 5-10 years of ASA physical status I or II were divided into two groups of 40 each using random numbers table. Group P received propofol 3mg/kg for induction and 100-400 µg/kg/min infusion for maintenance of anesthesia, while group S received sevoflurane 8% (inspired concentration) in 100% oxygen for induction and 2-3 % in oxygen for maintenance of anesthesia. No sedative premedication was given. Analgesia was provided with caudal block using 0.25% bupivacaine. Speed of emergence from anesthesia was assessed by time to extubation, time to eye opening, and time to crying / stating name. A modified aldrete score system was used to evaluate recovery while Pain/Discomfort scale to assess the quality of emergence from anesthesia. These were recorded by a separate consultant anesthetist blind to the anesthetic technique.

Results: Emergence from anesthesia occurred significantly quicker in the S group as compared to P group, as evident by times in minutes (mean ± SD) to extubation: 8.3±6.9 versus 4.7± 2.6(p=0.017), eye opening: 9.1 ± 5.3 vs. 5.6 ± 2.6 (p=0.043) & crying / state name: 14.7 ± 7.2 vs.11.3 ± 4.6(p=0.039). Similarly, more patients in the S group scored maximum points in the modified aldrete score at 10 min: 17 (42.5%) vs.7 (17.5%) (p=0.015), 20 min: 32 (80%) vs.23 (57.5%) (p=0.030). Although, number of patients in the S group compared to P group scoring max points in Pain-discomfort scale at 10 min: 8 (20%) vs4 (10%), p=0.210; 20 min: 6 (15%) vs.2 (5%), p=0.136 & 30 min: 4 (10%) vs. 0, p=0.130 were more, these results were not statistically significant.

Conclusion: VIMA with sevoflurane provided quicker emergence and early recovery compared with TIVA with propofol, in children undergoing ambulatory surgery.

Keywords: Ambulatory Surgery, Emergence, Propofol, Sevoflurane, Single Anesthetic Technique.

INTRODUCTION

Modern progress in anesthetic techniques, along with rising healthcare expenses have resulted in an ever growing number of surgical procedures being carried out on ambulatory (outpatient or day case / care) basis worldwide[1,2]. Although ambulatory surgery is still in its infancy in Pakistan, but the concept is steadily growing and increasing amount of surgery is being carried out now on day-case basis[3].

The optimal anesthetic technique for outpatient anesthesia should provide a rapid, smooth induction of anesthesia, stable hemodynamics with superior operating conditions, intraoperative amnesia and analgesia, and prompt awakening at the conclusion of the procedure[4]. The patients should experience minimal side effects and have a low rate of unanticipated hospital admission[5]. The availability of rapid and shorter acting volatile and intravenous anesthetic agents facilitates early recovery in the ambulatory setting[6].

Intravenous (iv) anesthetic drugs are used generally for induction of anesthesia followed by inhalational agents for maintenance[7]. A predicament with this practice is the transition

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phase from induction to maintenance. The lead to lightening of anesthesia before an adequate depth is achieved with the inhalational agent. This has promoted the rediscovery of single agent anesthesia, which avoid problems related with the transition phase[8].

Due to its pharmacokinetic and pharmacodynamics, profile[9], propofol has become the intravenous anaesthetic of choice in ambulatory anesthesia, fast track anesthetic techniques and monitored anesthesia care, and provides sedation for endoscopies and in the ICU[10]. This short acting general anesthetic agent is used extensively for TIVA because of its favorable induction properties and quick clearance due to its high metabolic clearance rate. The patient rapidly regains consciousness after discontinuation of the propofol infusion and may be discharged with minimal residual sedation after short outpatient procedures.

VIMA facilitates anesthesia without the need for iv drugs. Sevoflurane is highly fluorinated which results in a lower blood solubility leading to faster elimination from body and quicker recovery from anesthesia[11]. Therefore it is especially useful for ambulatory anesthesia.

Therefore, this study was designed to compare emergence and quality of recovery from anesthesia using TIVA with propofol and VIMA with sevoflurane, in children undergoing ambulatory inguinal herniorrhaphy.

PATIENTS AND METHODS

These randomized controlled trials were conducted at Shifa hospital of Pakistan Navy, from 01st Mar 2005 to 28th Feb 2006.

After approval of the hospital ethical committee and informed consent, 80 patients, age 5-10 years of either sex undergoing ambulatory inguinal herniorrhaphy of ASA I & II were included. Patients having acute infection, moderate to severe systemic disease, difficult airway, uneventful emergence from any previous anesthetic exposure and history of allergy to drugs under study were excluded.

rapid redistribution of intravenous agent could

A minimum of 6 hours fasting was ensured. Patients were hydrated and preoxygenated adequately before induction of anesthesia. Monitoring included temperature, pulse oximetry, electrocardiogram (ECG), non-invasive BP (NIBP) and capnography. Pre-induction heart rate (HR) and blood pressure (BP) were recorded as baseline. Dextrose saline (5%) at the rate of 4 ml/kg/hr was administered during the perioperative period.

No sedative premedication were given. A random numbers table was used to allocate children to receive either propofol (P group) or sevoflurane anesthesia (S group), of 40 children each. Group P received propofol 2mg/kg intravenous (iv) for induction and 100-400 µg/kg/min iv infusion for maintenance of anesthesia, while group S received inspired concentration (via a facemask) of sevoflurane 8% in 100% oxygen forinduction and 2-3 % in oxygen formaintenance of anesthesia.

Jackson-Rees modification of Ayre's T-piece circuit was used for the delivery of gases to the patients during anesthesia. The trachea was intubated three minutes after the administration of 0.5 mg/kg atracurium, in both groups. Caudal block with bupivacaine 0.25% was given by experienced consultant anesthetist for analgesia. The sevoflurane concentration or propofol infusion rate was adjusted to maintain adequate anesthesia as judged by the clinical signs and keeping the HR & BP within ± 20% of baseline.

At the end of procedure, propofol or sevoflurane were discontinued and lungs were ventilated with 100% oxygen. Residual neuromuscular block was pharmacologically antagonized with 0.05 mg/kg neostigmine and 0.1 mg/kg atropine.

Patients were asked repeatedly in normal tone of voice to open their eyes. When an appropriate response was obtained and spontaneous breathing was regarded as adequate, the oropharynx was suctioned and trachea was extubated.

In the recovery room, HR, BP & oxygen saturation were monitored until the child was fully awake.

The following were recorded by a consultant anesthetist blind to the anesthetic technique used:

Extubation time - time from discontinuation of anesthetic to the recovery of spontaneous breathing and removal of the endotracheal tube.

Time to spontaneous eye opening - time from discontinuation of anesthetic till the child spontaneously opened eyes and started crying or was able to state name.

Time to spontaneous crying / state name - time from discontinuation of anesthetic till the child started crying or was able to state own name.

Recovery characteristics and the quality of emergence were compared using:

Modified Aldrete score[12].

Pain Discomfort scale[13].

These were recorded by a consultant anesthetist blind to the anesthetic technique, for the first half hour every 10 minutes after arrival in the recovery room for the first half hour an then every 15 minutes until discharged from recovery room.

Statistical Analysis

Statistical analysis was performed using SPSS version 11. Descriptive statistics was used to describe the data. Chi-square test was used to compare qualitative variables while Wilcoxon Signed-Ranks test was used to compare quantitative variables between both the groups. A p-value<0.05 was considered significant.

RESULTS

There were 24 (60%) males in P group while 23 (57.5%) males in S group. Both the groups were comparable in term of patient's demographic data, duration of surgery and anesthesia.(Table: 1)

Emergence from anesthesia occurred significantly quicker in the S group as compared to P group, as evident by times to extubation (p=0.017), eye openings (p=0.043) & crying / state name (p=0.039) (Table:2). Similarly, more patients in the S group scored maximum points in the modified Aldrete score at 10 min (p=0.015) and 20 min (p=0.030). This yet again indicated an early recovery.

Table-1: Demographic data, duration of surgery and anesthesia.

Demographic data	Propofol group (n=40)	Sevoflurane group (n=40)	*p*-value
Age(yrs) (mean± standard deviation)	5.8 ± 1.9	6.3 ± 1.6	0.207
Weight (kg) (mean ± standard deviation)	22.4 ± 7.2	24.2 ± 6.4	0.241
Height (cm) (mean ± standard deviation)	118 ± 24.1	123 ± 26.3	0.378
Duration of Surgery (min) (mean ± standard deviation)	37.7 ± 12.4	34.5 ± 9.0	0.190
Duration of anesthesia (min) (mean ± standard deviation)	43.6 ± 13.2	42.5 ± 10.8	0.684

Values were expressed as Mean ± SD

Table-2: Times to extubation, spontaneous eye opening and crying / stating name.

Emergence times (min)	P group (n=40) Mean ± SD	S group (n=40) Mean ± SD	*p*-value
Time to extubation	8.3 ± 6.9	4.7 ± 2.6	0.017
Time to eye opening	9.1 ± 5.3	5.6 ± 2.6	0.043
Time to crying / state name	14.7 ± 7.2	11.3 ± 4.6	0.039

However, at 30 min (p= 0.057) & 45 min (p=0.061), the difference was insignificant. Likewise, more patients in S group scored maximum points in Pain-Discomfort scale at 10 min (p=0.201), 20 min (p=0.136) and 30 min (p=0.130). However, these results were again not statistically significant.

While at 45 min onwards, none of the patients in either group scored maximum points in the Pain-Discomfort scale (Table 3).

Table-3: No of patients (%) achieving maximum scores after discontinuation of anesthetic drug

Time after discontinuing drugs (min)	Modified Aldrete score Full/Max (8)			Pain Discomfort scale Full/Max (6)		
	Propofol (n=40)	Sevoflurane (n=40)	p-Value	Propofol (n=40)	Sevoflurane (n=40)	p-Value
10	7(17.5%)	17(42.5%)	0.015	4(10.5%)	8(20%)	0.210
20	23(57.5%)	32(80%)	0.030	2(5%)	6(15%)	0.136
30	28(70%)	35(87.5%)	0.056	0 (0%)	4(10 %)	0.116
45	31(77.5%)	37(92.5%)	0.060	0 (0%)	0 (0%)	1.000
60	40(100%)	40(100%)	1.000	0 (0%)	0 (0%)	1.000

DISCUSSION

The primary objective of this study was to compare the emergence from anesthesia and recovery characteristics of sevoflurane versus propofol, two of the best anesthetic agents for ambulatory surgery.

In our study, induction with both propofol and sevoflurane was well tolerated and no complication occurred during anesthesia.

Patient undergoing VIMA with sevoflurane displayed a quicker emergence from anesthesia as compared to TIVA with propofol, as shown by significantly shorter time to extubation, eye opening and stating name / crying.

The result sin this study were in consistence with those observed by Moore[14] who compared sevoflurane against propofol and halothane in pediatric ambulatory surgery and found that patients anaesthetized with sevoflurane recovered significantly earlier as compared to propofol and halothane.

Our study revealed that early recovery was quicker with sevoflurane than with propofol for but late recovery was not affected. Hugo and associates also concluded that sevoflurane is associated with more rapid early recovery than propofol[15]. Likewise, our results were also consistent with studies carried out by Maidatsi[16] and Peduto[17].

More children in the sevoflurane group were crying, restless or agitated upon awakening in the S group than in the P group. This resulted in children scoring higher in Pain-Discomfort scales in the recovery room at 10, 20 and 30 min after discontinuation of anesthesia. These findings were in accordance with those found by Viitanan H and associates. We could not define the mechanism for this. One of the reason could be the faster emergence resulted in pain occurring earlier in the S group. Many studies, including one carried out by Jae HwanKim, proposed that the quick elimination of residual anesthetics, due to low blood solubility of sevoflurane, caused emergence agitation in some patients[19].Nonetheless, Pain-discomfort scale does not discriminate between pain and agitation due to other causes.

Statistically significant patients in the S group also scored maximum points in the modified Aldrete score, again displaying quicker recovery from anesthesia compared to the p group.

Our study also backs the clinical impression that a more precise prediction of emergence time is possible following anesthetization with sevoflurane than propofol.

We also noticed that the higher Pain-Discomfort scale in the S group

correspondingly lead to a longer stay in the PACU despite a earlier emergence than the P group.

In contrast to the above, Magni[20] and J. R. Sneyd[21] could not find statistically significant dissimilarity in recovery from anesthesia amongst the two groups.

In summary, VIMA with sevoflurane resulted in a faster emergence and a quicker recovery as compared to TIVA with propofol. As regards the quality of emergence, sevoflurane anesthesia also resulted in more patients scoring maximum Pain-discomfort scale points. If pain, restlessness or agitation can be pharmacologically prevented, sevoflurane stands out to be an appropriate anesthetic drug for pediatric ambulatory surgical procedures using single anesthetic technique.

CONCLUSION

VIMA with sevoflurane provided quicker emergence and early recovery compared with TIVA with propofol, however the quality of recovery was significantly better in the propofol in children undergoing ambulatory surgery.

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