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Volatile induction and maintenance (VIMA) versus total intravenous anaesthesia (TIVA) for minor gynaecological procedures

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Abstract

We compared the techniques of volatile induction and maintenance (VIMA) and total intravenous anaesthesia (TIVA) in various aspects. Patients undergoing spontaneous respiration-general anaesthesia were randomised into two groups; Group P received iv fentanyl 1 μg/kg and propofol 2 mg/kg for induction followed by propofol 10 mg/min as required. Group S received vital capacity induction with sevoflurane and were maintained on 66% N_2O in O_2 with sevoflurane 2%. Induction times, complications and recovery times were recorded. Visual analogue scores for pain and satisfaction were assessed. The two groups did not differ significantly in emergence times or VAS scores for pain and satisfaction but more complications like apnoea and injection pain were encountered during TIVA compared to VIMA. Our results suggest that both techniques are comparable in efficacy for providing anaesthesia in minor gynaecological surgery with swift induction, good recovery and minimal postoperative complications.

Keywords: VIMA; TIVA; Dilation and curettage; Propofol; Sevoflurane

1. Introduction

Sevoflurane has been suggested to be the long awaited, ideal inhalational anaesthetic for its properties of being pleasant smelling, relatively non-irritating to the airways and its low blood-gas solubility which allows rapid induction and recovery from anaesthesia [1].Clinicians have taken advantage of these attributes to adopt it for volatile induction and maintenance (VIMA), especially in the day surgery setting, since it has a potential to allow 'fast-tracking' of patients [2].

A contrasting but also popular technique for day surgery is total intravenous anaesthesia (TIVA) with propofol which boasts rapid induction and recovery [3].

Although previous studies have compared sevoflurane and propofol for day surgery anaesthesia, this has mainly involved the induction phase [1]or maintenance with muscle relaxants [4]. We undertook to study the efficacy of these techniques on spontaneously breathing patients for short duration surgery such as dilatation and currettage. Also, it was intended that diclofenac suppositories be used for pain relief, so that we could assess the acceptability of suppository use in our population, the incidence of side-effects and whether it provided appropriate pain relief for these cases.

2. Methods

After obtaining institutional ethics board approval and informed consent, 80 ASA I & II patients scheduled for dilation and curettage of the uterus with hysteroscopy were enrolled. Exclusion criteria included patients with clinically significant cardiovascular, pulmonary, hepatic, renal, neurologic, psychiatric or metabolic diseases. Those who had general anaesthesia 7 days prior to the study were also excluded. Patients were randomly assigned to either of the two treatment groups: group P received IV fentayl 1 μg/kg and propo-

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fol 2 mg/kg for induction followed by propofol 10 mg/min as required. Group S received vital capacity induction with sevoflurane and were maintained on 66% N_2O in O_2 with sevoflurane 2% as the set-point for maintenance.

Consistent with our day surgery procedure, no premedication was used. In the operating room, routine monitors were applied and a 20G Venflon peripheral IV cannula was secured on the dorsum of the hand.

Group P patients were induced with IV fentayl 1 μg/kg given 2 min prior to a pre-calculated induction dose of propofol premixed with 20 mg of lignocaine 1% which was administered over 30 s. At the loss of eyelash reflex, the patient was positioned in the lithotomy position and surgery commenced. Intravenous propofol boluses of 10 mg were administered every minute as required to maintain anaesthetic depth as judged by clinical signs and hemodynamic responses to surgical stimuli. A 50% O_2/air mixture was given by face mask.

Group S patients were induced with a vital capacity breath of 8% sevoflurane from a primed circle circuit with 8% sevoflurane in a 66% nitrous oxide/oxygen mixture. Anaesthetic concentration at the Y piece was confirmed by a capnometer. Prior to induction the patients were trained in the technique of vital capacity breaths and care was taken to avoid hyperventilation. At the loss of eye reflex, the patient was positioned, diclofenac suppositories 100 mg were inserted and surgery commenced. Maintenance in this group proceeded with an end-tidal sevoflurane value of 2% as the set point.

When surgery was concluded, either sevoflurane was turned off or no further boluses of propofol were administered. The patients were then transferred to the post anaesthetic care unit (PACU) where further monitoring continued. Rescue medication was given as necessary by way of iv fentanyl for pain or iv maxolon for nausea or vomiting.

Intraoperatively, the induction time as denoted by loss of eyelash reflex was determined from time of commencement of propofol injection or mask inhalation. An independent but unblinded observer recorded complications encountered like pain on injection, breath holding, hiccups or movement. Apnoea was defined as loss of spontaneous respiration for more than 30 s and hypoxaemia as a pulse oximetry reading of less than 90%. Duration of surgery was recorded from time of cleansing to removal of speculum. In the recovery, time to opening eyes on demand (checked at 15 s intervals from termination of anaesthetic) was recorded.

Likewise, time to recall name and address was determined by an independent observer. The patient was also asked to assess the degree of pain and satisfaction based on a visual analogue scale of 0–100 after regaining consciousness for 1 h. Other side effects like awareness intraoperatively, nausea and vomiting were ascertained. Any complications encountered during emergence were recorded by the independent observer.

Table 1

	Group I	Group II
Number (n)	39	41
Induction time (s)	39.2 ± 7.0	40.4 ± 13.1
Surgery time (s)	389 ± 150	415 ± 174
Apnea	54%*	7.8%
Injection pain	18%*	0%
Hypoxaemia	2.5%	2.4%

3. Results

The two study groups were comparable with respect to age, weight, ASA status and duration of surgery (refer to Table 1). There was a significantly higher incidence of apnoea ($P < 0.01$) and injection pain ($P < 0.05$) in the propofol group. In the sevoflurane group, two patients had movements during induction and one patient developed a cough with copious secretions. In the propofol group, two patients had movements after induction and one patient had laryngospasm. In each group one patient developed hypoxaemia. Overall, there were no cases of intraoperative awareness.

Emergence times from discontinuation of the anaesthetic to eye opening, recalling name and address were similar in both groups. (refer to Table 2). Likewise, the VAS scores for pain and patient satisfaction were similar in both groups. Although there was a higher incidence of nausea noted in the sevoflurane group, this was not statistically significant. There was a patient preference towards TIVA instead of VIMA for a repeat anaesthetic.

None of the patients in group S objected to the use of diclofenac suppositories and no immediate complications like hypersensitivity arose from it.

Table 2

	Group I	Group II
Time to eye opening (s)	307.6 ± 116.2	400.4 ± 140.3
Time to recall name (s)	334.6 ± 111.1	415.9 ± 143.7
Time to recall address (s)	345.6 ± 115.1	427.4 ± 145.5
Pain score	36.64	44.17
Satisfaction score	88.33 ± 19.3	87.07 ± 17.4
Nausea (%)	0	2.5
Awareness (%)	0	0
Agreeable to same anaesthetic (%)	100	92

4. Discussion

Sevoflurane induction was swift and in a single vital capacity breath produced onset of anaesthesia within 40 s which is comparable to that previously reported by Yurino [5].

Our results demonstrated a smooth induction with good tolerability of sevoflurane even at such high concentrations in unpremedicated patients, without the use of adjunctive drugs to obtund airway irritation or cough reflex [6]. Due to the rapid equilibration between inspired and alveolar anaesthetic concentrations, surgical depth was reached sufficiently to allow patient positioning, cleansing and surgical commencement in rapid succession without ill effects on the patient.

The TIVA technique also induced patients quickly but was fraught with more complications during induction especially apnoea. This could have arisen from the administration of an analgesic dose of intravenous fentanyl, given prior to induction, for two reasons. Firstly, as pain on propofol injection is well documented [7,8], it should help to alleviate this. Secondly, since propofol has poor analgesic properties [9], fentanyl provides intraoperative analgesia . Fentanyl's inclusion helps provide balanced anaesthesia.

Even so, there was difficulty in controlling the depth of anaesthesia with the TIVA technique which resulted in apnoea after induction and then at the critical moment of surgical stimulation, movement and laryngospasm from light anaesthesia. Indeed, awareness is a great concern with the TIVA technique. Midazolam has been recommended to reduce the rate of intraoperative awareness significantly without influencing recovery profiles or discharge times from the day care unit [10].

In our study, the patients that moved and experienced larygospasm denied intraoperative awareness. This could be due to the low level of noxious stimulus from the procedure, avoidance of muscle relaxants and the use of propofol at an average rate of 150 μg/kg/min. However, it is unnerving for the clinician when having to overcome these problems, to administer a large bolus of propofol quickly, resulting in apnoea and thus be drawn into a vicious cycle.

The VAS pain scores at 1 h was comparable between the two groups despite short-acting intravenous fentayl being used in the propofol group in contrast to diclofenac suppositories, which have a long onset time, being used in the sevoflurane group. This may be explained by the procedure being most 'painful' at the time of dilatation of the cervix with little post-operative after effects and pain scores taken only at 1 h post-surgery. It is postulated that diclofenac suppositories have an added advantage of a sustained and comfortable recovery for the patients without the adverse effects of opioids [11]. However, the relative bioavailability of suppositories is low at 55% [12] and recent studies have shown that there may be a reluctance for rectal drug administration [13]. Our patients were not averse to this when told its purpose for analgesia but it still remains essential for the anaesthetist to inform patients beforehand to avoid undue stress to the patients.

Both groups were highly satisfied with their allocated anaesthetic technique but the TIVA group was more inclined to choose a similar repeat anaesthetic which is surprising considering that 18% had injection pain. Patients in the sevoflurane group rejected a repeat anaesthetic because of the 'smell'. We speculate that our patients may have preconceived expectation of pain on injection but are unprepared for inhaling a 'smelly gas'. Anaesthetists should bear in mind that not all will agree that sevoflurane has a pleasant odour and in these patients, sevoflurane induction may not be a good option.

The incidence of nausea in both groups was low although it was marginally higher in the inhalational group. The use of nitrous oxide has long been associated with postoperative emesis [14] whereas propofol has purportedly an antiemetogenic effect. This was illustrated in a study by Tramer, Moore and McQuay which showed TIVA to be superior in preventing early post-operative nausea and vomiting, thus reducing delays in discharge. There is no difference between TIVA and use of nitrous oxide in late emesis [15]. The low incidence of PONV is unexpected as the study population were all women undergoing dilatation of the cervix, both high risk factors for PONV [16,17]. Previous studies have found the incidence of nausea and vomiting in gynaecological surgery to be 30–70% even with antiemetics [18,19].

We have found both TIVA and VIMA anaesthesia to be appropriate for dilatation and curettage of the cervix and other minor surgery akin to this, for example, cystoscopy and urethral dilatation. Although the TIVA technique was more popular, complications of injection pain and apnoea reduced its anaesthetic appeal. Moreover, the VIMA technique has an added advantage in patients with poor venous access, phobia of needle puncture or a difficult airway.

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