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Research Article

Evaluation of Safety and Efficacy with Propofol and Etomidate for Induction of Anaesthesia in Dilatation and Curettage

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ABSTRACT:

Introduction and Aims: We compared the safety, efficacy, hemodynamic variation, recovery duration and adverse effects of propofol and etomidate, with or without fentanyl, in patients undergoing dilatation and curettage for incomplete abortions.

Materials and Methods: One hundred patients, ASA status I & II, aged 20-50 years, undergoing dilatation and curettage, were randomly divided into four groups of 25 patients each. Group P received propofol 2 mg/kg + normal saline 2 ml for anesthesia induction. Group PF received propofol 2 mg/kg +fentanyl 1mcg/kg to make volume 2 ml for anesthesia induction. Group E received etomidate 0.2 mg/kg + normal saline 2 ml for anesthesia induction and Group EF received etomidate 0.2 mg/kg + fentanyl 1 mcg/kg to make volume 2 ml for anesthesia induction. Heart rate, arterial pressure and SpO2 were recorded at differenttime intervals. The recovery time, pain on injection, myoclonus and postoperative nausea vomiting were also recorded.

Results: During induction, mean arterial pressure fall significantly in both propofol groups. Amongst four groups, there was no significant difference observed in recovery time after anesthesia. The incidence of pain on injection was lower in etomidate groups. Myoclonus and Postoperative nausea and vomiting were significantly higher in etomidate groups.

Conclusion: This study demonstrates that etomidate is superior in term of hemodynamic stability and less incidence of pain on injection. Etomidate combined with low dose fentanyl is more favourable than etomidate alone for attenuating myoclonus.

INTRODUCTION

Dilatation and Curettage (D&C) for 1st trimester abortion is the frequently performed outpatient surgical procedure in the obstetric practice. Therefore, rapid recovery from anesthesia is required. Though D & C is very safe procedure, it is still not completely risk free from either anesthetic or surgical point of view. Therefore, safe and appropriate anesthesia for D&C hasa great public health importance.

Over the years, there has been a never-ending search for safer and better intravenous induction agent with a quick recovery profile. Presently various agents are available for induction of anesthesia during outpatient anesthesia. Propofol, an alkyl derivative is commonly used intravenous anesthetic agent for induction in outpatient surgical procedures. However, propofol causes considerable fall in systemic vascular resistance (SVR) that causes

moderate to severe decrease in blood pressure.[1]

In contrast, etomidate produces minimal cardiacand respiratory depression and has very stable hemodynamic profile; thereby etomidate is thought to be safer as compared to other rapid onset induction agents.[2] However, myoclonus and postoperative nausea and vomiting (PONV) is the frequent adverse effects of etomidate. So, etomidate is not a preferred choice for the day care surgical procedures. However, these side effects of etomidate might be significantly minimized by use of midazolam or opioids like fentanyl.[3,4]

This study was undertaken to assess the hemodynamic changes and side effects related to anesthetic induction with propofol and etomidate. Concurrently, effects of fentanyl pretreatment on incidence of side effect-myoclonus were also studied.

Materials and Methods

After institutional ethical committee's approval andwritten informed consent this prospective double blind study was conducted on one hundred females of 6-8 weeks pregnancy, American Society of Anesthesiologists physical (ASA) status I and II, aged 20 to 50 years who were undergoing dilatation & curettage for incomplete abortion under general anesthesia. Patients, who were unable to give consent, had a history of hypertension, ischemic heart disease, diabetes mellitus and bronchial asthma and had a known hypersensitivity to either medication, were excluded from the study.

All patients in this study were undergone thorough pre-anesthetic evaluation including clinical history, airway assessment, general & systemic examination and routine biochemical investigations. The patients were randomly divided into four groups of 25 patients each. Group P administered propofol 2 mg/kg + normal saline 2 ml for anesthesia induction. Group PF administered propofol 2 mg/kg + fentanyl 1mcg/kg to make volume 2 ml for anesthesia induction. Group E was given etomidate 0.2 mg/kg + normal saline 2 ml for anesthesia induction and in group EF, patients were given etomidate 0.2 mg/kg + fentanyl 1 mcg/kg to make volume 2 ml for anesthesia induction. To ensure proper blinding, the coded syringes contained propofol, etomidate, fentanyl or normal saline were prepared by another anesthesiologist.

In operation theatre, patients were examined to confirm the findings of pre-anesthetic check-up and were enquired about the fasting status. An intravenous line was secured with 20 G cannula. Multiparameter monitor was attached. Lead II & V_5 were monitored on electrocardiogram. Oxygen saturation (SpO_2) via pulse oximetry was continuously monitored. An automated blood pressure cuff was applied to the right arm tocheck blood pressure.

No local anesthesia was given. All patients were premedicated with injection midazolam 0.02 mg/kg and glycopyrrolate 0.2 mg. Fentanyl 1 mcg/kg or normal saline was given over a period of 30 sec according to group allocated. Two minutes later propofol 2mg/kg or etomidate 0.2mg/kg was administered over a period of 60sec. At the end of induction, D&C was performed. During the procedure, if required, as per group allocation, either 2% propofol or 0.2% etomidate was supplemented as a 1-2 ml bolus. Each patient received approximately 500 ml ringer lactate. After completion of D&C, patients were monitored in the recovery room for 2 hours and then discharged.

During the procedure heart rate, mean arterial pressure, SpO_2 & ECG were monitored and values were recorded just before induction (baseline), just after induction, just after completion of procedure and thenat 10 minute interval till 1 hr and 20 minute interval till discharge of the patient from recovery room. Bradycardia, defined as pulse rate below 50 beats per minute, was treated by atropine 0.6 mg. Hypotension was considered when mean arterial pressure dropped by >20% from

baseline and it was treated by ephedrine 3mg bolus. Operative time was considered as time between insertion of speculum to removal of speculum and recorded. Duration of anesthesia was calculated from the moment the patient lost consciousness to the moment of awakening. Recovery was assessed by observing

a) Time to eye opening (time in minutes measured from end of anesthesia to eye opening either spontaneously or to verbal commands).

b) Time to obeying commands (time in minutes measured fromend of anesthesia to ability to answer question such as 'What is your name?)

c) Post anesthesia care unit (PACU) recovery time (time in minutes from end of anesthesia to attain adequate recovery as denoted by a Modified Aldrete Score[5] (MAS ≥9) (Table 1).

Myoclonus, a brief and involuntary twitching of a muscle or a group of muscles was recorded on a scale between 0 and 3, where 0 = no myoclonus, 1 = mild (only mild fasciculation involving face / distalupper/lower extremities), 2 = moderate (marked movements of face /limb), 3 = severe (involving limbs & trunk). A side effect such as pain on injection of induction agent was assessed on binary scale (yes/no). Post-operative nausea and vomiting (PONV) was recorded as yes/no.

Statistical analysis was done by using student 't' test & Chi-square test and a p value less than 0.05 was considered to be significant.

Results

In the present study, all four groups were comparable with regard to age, weight, ASA status,duration of surgery and anesthesia and baseline vitals (Table 2).

All four groups were comparable to changes in heart rate during the study period. We observed a significant decrease in MAP as compared to baseline, after the induction in propofol groups (Group P & PF), while MAP changes were insignificant as compared to basal values in etomidate groups (Group E & EF). Though a significant fall in MAP after the induction in both propofol groups was noticed but none of the patient had required any intervention for hypotension. In our study mean SpO_2 and end tidal CO_2 measured at various time intervals were comparable in all four groups.

We did not observe any significant changes in recovery times (from eye opening on verbal commands to the time at patient achieved MAS ≥9 in all fourgroups ($p > 0.05$) (Table 3).

With respect to myoclonus and PONV, incidenceof these two side effects was higher in etomidate groups as compared to propofol groups. None of the patient in propofol group had myoclonus while, in E and EF groups, 20% and 8% patients respectively showed myoclonus of variable grades (Table 5).

During induction, with respect to pain on injection, there was a significant difference between the propofol groups & etomidate groups. Forty and 24% patients hadexperienced pain on injection in group P & PF respectively as compared to 8% and 4% patients ingroup E & EF respectively (Table 5).

Significantly a small number of patients in propofol groups developed PONV as compared to etomidate groups (Table 5). However, occurrence of myoclonus and PONV was comparable among two etomidate groups.

Table 1: Modified aldrete score

Discharge criteria	Score
Activity: Able to move voluntarily or on command	
All Four extremities	2
Two extremities	1
Zero extremities	0
Respiration	
Able to deep breathe and cough freely	2
Dyspnea, shallow or limited breathing	1
Apneic	0
Circulation	
Blood pressure +/ 20 mm of preanaesthetic level	2
Blood pressure +/ 20 – 50 mm preanaesthesia level	1
Blood pressure +/ 50 mm of preanaesthesia level	0
Consciousness	
Fully awake	2
Arousable on calling	1
Not responding	0
O2 saturation	
Able to maintain O2 saturation > 92% on room air	2
Needs O2 inhalation to maintain O2 saturation >90%	1
O2 saturation < 90% even with O2 supplementation	0

Table 2: Patient Characteristics (Mean ±SD)

	Group P(n=25)	Group PF(n=25)	Group E(n=25)	Group EF (n=25)
Age (years)	33.95±2.8	32.8±3.5	33.85±2.8	33±4.2
Weight (kg)	49.6±1.4	48.8±3.5	48.8±2.1	50.3±2.1
Duration of Surgery (min.)	2.9±6.9	4.3±2.1	3.1±3.3	4.4±2.1
Duration of Anesthes (min.)	18.6±4.2	18.4±2.1	17.5±0.7	17.9±2.1

Table 3: Recovery Time (minute) (mean +SD)

Recovery Score	Group P (n=25)	Group PF (n=25)	Group E (n=25)	Group EF(n=25)
Time to eye opening	2.5 ± 0.7	3.2 ± 0.7	2.25 ± 1.4	2.3 ± 2.1
Time to obeying command	4.25 ± 1.4	4.85 ± 0.7	4 ± 1.4	4.4 ± 0.7
Time to achieving MASS ≥ 9	6.05 ± 0.7	7.6 ± 1.4	6 ± 1.4	6.5 ± 0.7

P >0.05 Group E, EF vs P, PF

Table 4: Myoclonus grade

Grade	Group P		Group PF		Group E		Group EF	
	No. of Patientsn	%	No. of Patientsn	%	No. of Patientsn	%	No. of Patientsn	%
0	0	0	0	0	0	0	0	0
1	0	0	0	0	5	20*	2	8*
2	0	0	0	0	1	4	0	0
3	0	0	0	0	0	0	0	0

*p<0.05 Group E, EF vs P, PF

Table 5: Side effects

Side effects	Group P		Group PF		Group E		Group EF	
	No. of Patientsn	%	No. of Patientsn	%	No. of Patientsn	%	No. of Patientsn	%
Pain on injection	10	40*	6	24	2	8	1	4
Postoperative nausea and vomiting	1	4	2	8	7	28#	9	36#
Allergic Reaction	0	0	0	0	0	0	0	0

*p<0.05 Group E, EF vs P, PF#p<0.05 Group P,PFvs E, EF

Discussion

To decrease the time spent in recovery room during outpatient surgical procedures, an induction agent with a rapid recovery and minimal residual sedation is needed. Propofol is frequently used for outpatient surgical procedures because of its rapid onset and recovery action with minimal residual sedation. An imidazole derivative, etomidate also shares favorable features of rapid onset and recovery profiles.

Furthermore, etomidate also related with high degree of hemodynamic stability.[6] Although etomidate reportedto suppress adrenocortical functions, a single injection used for induction of anesthesia will only produces a momentary and clinically insignificant changes in adrenocortical functions.[7-9]

In the present study, we have assessed and compared the efficacy and safety of propofol and etomidate with or without fentanyl in patients undergoing dilatation and curettage for first trimester abortion.

In our study, we found that the both induction agents either propofol or etomidate during anesthesia for D&C provided hemodynamic stability even ifarterial pressure was found to be significantly lower in propofol group, though this difference was clinically insignificant. These results are in accordance with the previous studies which also found significant decrease in arterial pressure following induction with propofol.[10] As reported in earlier studies, we also noticed a fall in blood pressure in propofol groups but this fall in blood pressure appeared to have no clinical consequences because of healthy status of the studied patients. The mechanism for hypotension after propofol induction is multifactorial. The decrease in arterial pressure after the propofol is related with both, vasodilatation with reduced preload and afterload and myocardial depression as a result of the negative inotropic effect.[11,12] This fall in arterial pressure is caused by sympathetic nervous system inhibition and baroreceptor regulatory mechanism impairement.[13] Similar to our results, Saricoaglu et al[14] found that propofol was associated with significant fall in blood pressure as compared to etomidate and attributed this fall in blood pressure to the negative ionotropic effectof propofol. On the contrary, etomidate uniquely has the capacity to bind and stimulate peripheral alpha-2 beta adrenergic receptors with subsequent vasoconstriction[14] and also etomidate does not have effect on sympathetic nervous system and baroreceptor function.[15] These distinctive effects may be responsible for the hemodynamic stability after etomidate.

Propofol administration is related with higher incidences of pain on injection. In this study, we also observed higher incidences of pain on injection in propofol groups as compared to etomidate groups. Our results are consistent with other studies which also reported higher incidences of pain on injection with the use of

propofol.[16-18] In a study, while comparing etomidate and propofol, Nyman et al[7] also observed pain on injection in 5% patients with etomidate as compared to 47% patients with propofol.

Main undesirable side effect of the etomidate is myoclonus.[19,20] It is observed up to 90% of patients during induction of anesthesia with etomidate.[21]In present study, the incidence of myoclonus observed in patients who had received etomidate was higher as compared to patients who had propofol. Twenty percentand 8% patients had myoclonus in group E and EF respectively while none of the patients in propofol groups had myoclonus. In a study by Miner et al,[22] a higher incidence of myoclonus (20%) in etomidate treated patients was observed as compared to 1.8% in propofol treated patients. The mechanism of myoclonus is still debatable, however both midazolam and fentanylare found to attenuate the myoclonus effectively.[3,23,24] Therefore in our study, we used midazolam as premedication in all patients. By using the etomidate- fentanyl combination, only 10% patients developed myoclonus but still they were more frequent when compared to none in the propofol groups.

The recovery times in all four study groups were comparable and all patients had smooth and rapid recovery. Alike results of previous studies,[13,25] we also found higher incidence of nausea & vomiting in etomidate groups. In our study, none of the patients had cough, laryngospasm, bronchospasm, respiratory depression and cyanosis in all groups in postoperative period.

Conclusion

In conclusion, our comparison of etomidate and propofol found that both agents can be used for induction of anesthesia in D&C but etomidate was better for maintaining hemodynamic stability and less incidence of pain on injection. A higher incidence of myoclonus was the major drawback with the etomidate which can be decreased by midazolam during premedication. Furthermore, etomidate with fentanyl is found to be more beneficial than etomidate alone for decreasing myoclonus.

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