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RESEARCH ARTICLE

EFFECTS OF PRELOADING WITH INTRAVENOUS FLUIDS (CRYSTALLOIDS) ON PROPOFOL-FENTANYL INDUCED HEMODYNAMIC CHANGES DURING GENERAL ANAESTHESIA

[1]Dr. Surendra Kumar, [2,*]Dr. Desh Pal Singh and [3]Dr. Praveen Kumar

[1]Professor and Medical superintendent, Department of Anaesthesia and Critical Care, Rama Medical College Hospital and Research Centre, Pilkhuwa, Hapur (U.P.)

[2,*]Associate Professor, Department of Surgery, Rama Medical College Hospital and Research Centre, Pilkhuwa, Hapur (U. P.)

[3]Associate Professor, Department of Anaesthesia and Critical Care, Rama Medical College Hospital and Research Centre, Pilkhuwa, Hapur (U.P.)

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Corresponding author:
Dr. Desh Pal Singh

ABSTRACT

Background: Propofol and fentanyl are the commonly used drugs for induction of general anaesthesia. Propofol when given alone does not cause much changes in hemodynamic status of normal healthy (ASA grade1) individuals. When it is given in combination with fentanyl causes detrimental effects in patients especially compromised patients. The most common deleterious effects is hypotension and other cardio respiratory disturbances. These hazardous and sometimes fatal effects can be reduced and eliminated by preloading the patients with crystalloid solutions (Ringer Lactate). This study was planned to find the effects of preloading the patients with crystalloid fluids and study the hemodynamic effects of these drugs during induction of general anaesthesia. **Objective:** To find out the effect of intravenous crystalloid fluids preload on haemodynamic changes produced by propofol and fentanyl induction in general anesthesia. **Method**: We selected 60 patients who visited this hospital. All the investigations and pre-anaesthetic check-up was done routinely. These patients had to undergo different surgical procedures under general anaesthesia. The induction of anaesthesia was done with propofol and fentanyl. These patients were divided in two groups A and B. Group A patients did not receive any preloading with fluids. Group B was preloaded with crystalloid (Ringer Lactate solution). The hemodynamic changes were noted and analysed statistically. **Conclusions**: We concluded that preload with crystalloids fluids is beneficial to counter the detrimental effects of propofol and fentanyl induction for general anaesthesia. The preload of fluid stabilise the patient haemodynamically.

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INTRODUCTION

General anaesthetics are the drugs that produce reversible loss of sensation and consciousness. A wide variety of chemical agents produce general anaesthesia. In the modern practice of balanced anaesthesia these modalities are achieved by using combination of drugs for each specific purpose. These drugs may be in the form of inhalational or intravenous agents. Propofol is the recent intravenous anaesthetic agent used in clinical practice. It is used for induction and maintenance of anaesthesia as well as sedation but it does not have analgesic property. It is short acting and has no residual effect.

So it is used very commonly with short acting opioids like fentanyl or alfentanil which possesses good analgesic effects. This combination is commonly used in day care surgeries where early ambulation is required. When both propofol and fentanyl are used during induction of general anaesthesia they have effects on blood pressure and heart rate. Propofol inhibits sympathetic vasoconstriction causing vasodilation so causing fall in blood pressure (Grounds, 1985; Al Khudain, 1982). It is reported that it decreases 25-40% systolic pressure and diastolic pressure (Patrick, 1985; Coats, 1987). Propofol is a vasodilator and myocardial depressant drug but it does not change heart rate significantly. Fentanil is a synthetic opioid.

Most evidences indicate that it does not change arterial blood pressure, heart rate, cardiac output or pulmonary vascular resistance. Pulmonary wedge pressure remains unchanged with fentanyl (Stanly, 1978; Lunn). But the combination of propofol with fentanyl may produce significant changes in haemodynamic parameters. Fentanil produces conduction delay while propofol reduces blood pressure. These changes are well tolerated in healthy patients (ASA grade I) but will be detrimental in patients with systemic diseases. It is better to control these changes before their occurrence following concomitant use of propofol and fentanyl. Subarachnoid block produces fall in blood pressure and this can be prevented by preloading the patient with intravenous fluids. And so haemodynamic changes induced by propofol and fentanyl can also be prevented by preloading with intravenous fluids. In the present study the patients were preloaded with crystalloids (Ringer Lactate) over a period of 30 minutes before induction of anaesthesia with propofol and fentanyl. Haemodynamic changes were measured before and after induction of anaesthesia in two groups.

MATERIAL AND METHODS

The study was conducted in the Department of Anaesthesiology, Critical Care and Preoperative Medicine, Rama Medical College Hospital and Research Centre, Pilkhuwa, Hapur, U.P., India. Due approval of the Ethics committee was obtained. 60 patients between 20-40 years of age of both sexes belonging to ASA grade-1 were included in the study. These patients were scheduled for different elective surgeries under general anaesthesia. Pre-anaesthetic check-up of all the patients was done. All the relevant investigations were carried out e.g. Hb, BT, CT, TLC, DLC, Platelets Counts, HIV, HCV, HbsAg, Blood sugar, Blood group, Renal function Tests, Liver Function Tests, Urine complete examination, Chest X-Ray and ECG were performed in each case. Patient with difficult intubation, h/o Drug allergy, Renal, Hepatic and Neuromuscular diseases were not included in the study.

Premedication: All patients were kept nil orally in the night before surgery. All patients received tab. Alprazolam 0.25mg.and Ranitidine 150 mg orally in the night before and at 6.00 AM on the day of surgery with a little water. A total number of 60 patients were selected for the study. Patient were randomly divided in two groups of 30 patients each.

Group A: No preloading with fluids was given.

Group B: Received 15ml/kg crystalloid (Ringer Lactate) over 30 min just before induction at the rate of 30 ml/kg/hour.

Induction of anaesthesia: Base line heart rate, systolic and diastolic blood pressure were recorded at the time of fluid infusion and at the end of infusion. Patients were given 100% oxygen for three minutes. Induction was done with fentanyl 1.5 µg/kg and propofol 2.5mg/kg over a period of 30 seconds. Endo tracheal Intubation was performed with vecuronium 0.1mg/kg and maintained on Oxygen, nitrous oxide and isoflurane with controlled ventilation.$EtCo_2$Monitoring done in laparoscopic Surgeries and was maintained within normal range (30-40 mmHg). Any decrease in systolic blood pressure > 20% of base line was defined as hypotension and heart rate < 60 beats per minute was considered bradycardia.

Observed parameters: Heart rate: Heart rate was measured at the beginning of fluid preloading and every 2 minutes up to 20 minutes after induction.

Systolic, diastolic and mean arterial blood pressure at base line at the end of fluid load and every 2 minutes upto 20 minutes after induction was noted.

- $SpO_2$and ECG monitored throughout the surgery.
- $EtCO_2$monitored throughout the laparoscopic surgery.

On completion of study observations were tabulated and analysed. Demographic and clinical data were analysed to see the effect of fluid preloading. General anaesthetics are the drugs that produce reversible loss of sensation and consciousness. A wide variety of chemical agents produce general anaesthesia. In the modern practice of balanced anaesthesia these modalities are achieved by using combination of drugs for each specific purpose. These drugs may be in the form of inhalational or intravenous agents. Propofol is the recent intravenous anaesthetic agent used in clinical practice. It is used for induction and maintenance of anaesthesia as well as sedation but it does not have analgesic property.

Induction of anaesthesia: Base line heart rate, systolic and diastolic blood pressure were recorded at the time of fluid infusion (Ringer Lactate) and at the end of infusion. Patients were given 100% oxygen for three minutes. Induction was done with fentanyl 1.5 µg/kg and propofol 2.5mg/kg over a period of 30 seconds. Endo tracheal Intubation was performed with vecuronium 0.1mg/kg and maintained on Oxygen, nitrous oxide and isoflurane with controlled ventilation.$EtCo_2$Monitoring done in laparoscopic Surgeries and was maintained within normal range (30-40 mmHg).

Any decrease in systolic blood pressure > 20% of base line was defined as hypotension and heart rate < 60 beats per minute was considered bradycardia.

Observed parameters

- Heart rate: Heart rate was measured at the beginning of induction and every 2 minutes up to 20 minutes after induction.
- Systolic, diastolic and mean arterial blood pressure at base line at the end of fluid load and every 2 minutes upto 20 minutes after induction was noted.
- $SpO_2$and ECG monitored throughout the surgery.
- $EtCO_2$monitored throughout the laparoscopic surgery.

On completion of study observations were tabulated and analysed. Demographic and clinical data were analysed to see the effect of fluid preloading. This table shows mean of heart rate with standard deviation in two groups before preloading at the time of induction and then every 2 minutes for 20 minutes. In both groups the pattern showed decrease in heart rate from base line but slight increase at 8-10 min. which shows slight stress response due to laryngoscopy. Decrease in heart rate was statically significant in two groups ($p< 0.001$). This table shows mean systolic pressure with standard deviation in both groups. In both groups systolic blood pressure decreased from base line value but slightly increased at the time of intubation which occurred at 10 min.($p<0.001$). This table showed the mean diastolic pressure and standard deviation in two groups. In study group A the diastolic pressure decreased from the corresponding base line value except at the time of intubation which was at 10 minutes and at the end it touched the base line ($P < 0.001$). Table no. 6: This table showed mean of oxygen

saturation with standard deviation in two groups. The trend showed that there is no significant changes in base line value after induction in both groups.

RESULTS

In this study we found that propofol and fentanyl when given in combination cause fall in blood pressure during induction of General Anaesthesia.

Table 1. Demographic data

	Group A Without Preload	Group B Preload with Crystalloids
Age	32.70 ± 6.91	31.13± 6.67
Sex (M: F)	8: 22	13: 17
Body Wt. (kg)	51.53 ± 10.32	53.37± 11.96

Group A: The mean age was 32.70± 6.91 yrs.
Group B: The Mean age was 32.97± 6.83 yrs.

Table 2. Surgical procedures in the study

Surgeries	Group A Without Preload	Group B With Crystalloids
Laparoscopic cholecystectomy	17	19
Pyelolithotomy	7	6
Colostomy	1	
Fibroadenoma breast	2	4
Ileostomy	1	
Hysterectomy	1	
Hernia		1
Exp. Laparotomy	1	

Total no. Surgeries – 60 and these were all different operations.

Table 3. Comparison of heart rate in two groups

Time	Gr. A Mean± S.D.	Gr. B Mean ± S.D.
Base line	83.53 ± 6.12	81.73 ±6.34
At Induction	79.20 ± 5.33	76.30 ± 5.94
2 min	78.90 ± 6.99	73.07 ± 5.24
4 min	78.23 ± 7.89	72.00±3.83
6 min	77.93± 7.79	75.07± 4.92
8min	79.00± 7.19	76.63± 5.45
10 min	79.10± 6.63	76.67± 5.47
12 min	77.40± 5.66	77.37± 3.78
14 min	77.20± 5.16	77.60± 4.85
16 min	77.20 ±5.19	77.17± 4.67
18 min	78.40 ±6.17	77.63± 4.19
20 min	79.17± 5.65	78.47± 4.39

Table. 4 Comparison of systolic blood pressure in two groups

Time	Gr A(Mean±S.D)	Gr B(Mean ±S.D)
Base line	121.40 ± 7.45	119.67 ± 6.35
At Induction	115.83 ± 5.84	121.27± 4.18
2 Min	103.80± 10.79	114.00± 5.61
4 Min	105.83± 11.28	112.57± 5.75
6 Min	110.73± 11.93	114.80± 7.48
8 Min	112.70± 11.86	116.57± 8.34
10Min	113.97± 10.96	116.67± 8.26
12 Min	112.70± 10.61	117.60± 7.03
14 Min	113.87± 10.01	119.50 ± 5.46
16 Min	115.57± 9.99	119.13± 3.72
18 Min	117.40± 9.49	121.17± 6.09
20 Min	117.50± 9.28	122.20 ± 6.03

This fall was significant. The probable causes were peripheral vasodilatation, myocardial depression and conduction delays in heart muscles. There was not much change in oxygen saturation.

Table 5. Comparison of Diastolic Pressure in two Groups

Time	Gr. A (Mean S.D.)	Gr. B (Mean S.D.)
Base Line	77.67 ± 6.08	77.13± 5.35
At Induction	76.10± 4.95	79.57± 3.38
2 Min	68.27± 7.18	74.00± 4.39
4 Min	70.97± 8.33	72.60± 3.97
6 Min	73.03± 8.21	75.17± 3.97
8 Min	73.93± 8.23	77.60± 4.05
10 Min	75.20± 7.45	77.87± 3.77
12 Min	74.37± 6.75	78.70± 4.53
14 Min	74.50± 7.94	79.47± 4.17
16 Min	75.77± 7.91	79.70± 3.52
18 Min	76.30 ± 6.52	79.80± 3.43
20 Min	76.13± 6.09	80.77± 3.13

Table 6. Comparison of SPO_2 in two groups

Time	Gr.A (MeanS.D.)	Gr.B (Mean S.D.)
Base line	98.63± 0.67	98.77± 0.50
At Induction	99.60± 0.50	99.17± 0.59
2 Min	99.47± 0.51	99.87± 0.35
4 Min	99.70± 0.60	99.67± 0.48
6Min	99.97± 0.18	99.67± o.48
8 Min	99.83± 0.46	99.77 ± 0.43
10 Min	99.40± 0.77	99.70 ± 0.47
12 Min	99.57± 0.57	99.73± 0.45
14 Min	99.67± 0.55	99.47± 0.82
16 Min	99.80± 0.41	99.50± 0.51
18 Min	99.73 ± 0.53	99.17± 0.83
20 Min	99.80± 0.48	99.93± 0.26

We conclude that intravascular preloading with crystalloids just before the induction of anaesthesia with propofol and fentanyl is advantageous to control haemodynamic changes. This in accordance with other previous studies.

DISCUSSION

Propofol is supposed to be a very good drug for intravenous sedation. It has short duration of action. On intravenous administration it produces various haemodynamic effects generally dose dependant. It causes peripheral vasodilation and to some extent myocardial depression. Profopol anaesthesia is administered with fentanyl which is a short acting synthetic narcotic to provide analgesia. Fentanyl in therapeutic doses doesn't possess any significant effect on blood pressure, heart rate or other parameters of cardiovascular system. But when used in combination with propofol the toxic effects are synergised. These toxic effects are hypotension, asystole or respiratory depression. Hypotension produced in any case is threatening particularly in compromised patients. So it is better to prevent the hypotension and other adverse cardiovascular effects. As all know hypotension induced by subarachnoid block is prevented by preloading the vascular compartment with the crystalloid fluids (Perel, 2013; Singh, 2010). On this basis present study was designed.

In this study 60 patients were randomly chosen and divided in two groups (A and B) of 30 each. Group A did not receive any fluid preload and it was considered as control group. In group B patients received fluid preload with 15ml/kg body weight crystalloid (Ringer lactate).All patients received inj. Fentanyl (1.5µg/kg) and inj. Propofol (2.5 mg /kg for induction of anaesthesia. Anaesthesia was maintained with O_2 /N_2O, is of lurane and vecuronium 0.1mg/kg with controlled ventilation. Heart rate, SPO_2, blood pressure were recorded just before preloading and at the time of induction of anaesthesia then every 2 minutes up to 2o minutes. The recorded data were

compared to find the efficacy of fluid preloading. $Etco_2$ was maintain within normal range (30-40mm Hg). The results of present study showed statistically significant reduction in heat rate, systolic and diastolic blood pressure in comparison to their base line value. In control group A, base line heart rate was 83.53± 6.12 which decreased further and it was associated with decrease in systolic, diastolic and mean arterial pressure. In group B there was a decrease in heart rate in the same pattern as in group A. These changes were statistically significant ($P<0.001$) when compared with their base line value. On group to group comparison at each point of time the mean value of heart rate, blood pressure was comparable and there were no statistically significant changes. The findings of this study are comparable with other studies. Aun[7]et al (1984) studied the effect of propofol. They observed a significant decrease in systolic, diastolic and mean arterial pressure. In some studies it has been quoted that propofol if given alone does not change heart rate but when given with fentanyl significant change in heart rate occurred (Gliss, 1990; Cummings, 1984; Singh, 2016). Vohra and Woodey (Vohra, 1991; Wodey, 1999) in 1999 had observed no significant changes in heart rate with propofol administration. J.P. Williams *et al.* in (1986) observed no change with propofol alone but there was significant fall in heart rate when used with fentanyl. In the present study systolic, diastolic and mean arterial pressure was deceased significantly in two groups following administration of propfol and fentanyl. The maximum changes were at initial time of induction of anaesthesia. On group to group comparison the maximum fall in parameters was in group A (control group) but less fall in group B. The effect of hypotension can be minimised with preloading the patient with crystalloids (Kumar *et al.,* 2008; Perel *et al.,* 2013; Singh, 2010).

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