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Original Research Article

Effect of Propofol Infusion and Dexmedetomidine Fentanyl on Serum Biochemical Indices in ICU Patients

Sourabh Shrivastava[1], Ashwin Sharma[2], Divya Sinha[3], Swati Shrivastava[4]

[1]Associate Professor, Department of Anaesthesia, G.R. Medical College, Gwalior, M.P
[2]Senior Resident, Department of Anaesthesia, G.R. Medical College, Gwalior, M.P
[3]Assistant Professor, Department of Obstetrics and Gynaecology, G.R. Medical College, Gwalior, M.P
[4]Demonstrator, Department of Biochemistry, Government Medical College, Datia

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Corresponding Author: Dr. Swati Shrivastava
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Abstract:

Background: Sedation plays a pivotal role in the care of the critically ill intensive care unit patient. It is equally important to assess depth of sedation. Anesthetic agents can alter the hemodynamic variables, hematological and biochemical laboratory parameters.

Objectives: The purpose of this study was to compare the effect of propofol and dexmedetomidine on hemodynamic and biochemical parameters on ICU patients.

Methods: This was a cross sectional study conducted in the department of Anaesthesia. Hundred ICU admitted patients who required sedation were included in this study. The patients were randomly assigned into two equal groups of propofol and dexmedetomidine group. Hemodynamic parameters (heart rate and mean atrial pressure) were measured. Lipid profile, liver function test, renal function test and blood sugar were investigated in both groups of patients after sedation infusion.

Results: Heart rate and mean atrial pressure changes were significantly lower in dexmedetomidine group in all stages compared to propofol group ($P < 0.05$). Also, the lipid profile and other biochemical parameters were significantly higher in propofol group as compared to dexmedetomidine group ($p<0.05$).

Conclusion: Propofol showed significant difference in hemodynamic and biochemical parameters in comparison with dexmedetomidine. Dexmedetomidine is a safe and effective sedative agent as compared to propofol.

Keywords: Propofol, Dexmedetomidine, hemodynamic Parameters, biochemical parameters, ICU patients.

Introduction

Sedation is an essential component of the management of intensive care patients. It allows patient's unawareness of the environment and reduction of discomfort and anxiety caused by procedures such as tracheal intubation, mechanical ventilation, suction and physiotherapy. Benzodiazepines like midazolam, propofol and opioids are among the agents commonly used for sedation in intensive care unit (ICU) [1-2]. Inadequate sedation can result in hypercatabolism, immunosuppressant, hypercoagulability and increased sympathetic activity that are associated with significant outcome impairment [3]. Propofol produces a rapid onset of anaesthesia and a fast recovery. Its pharmacokinetic characteristics made it a widely used anaesthetic agent for surgical procedures and for sedation in intensive care units. Propofol affects the lipid profile of patients due to its oil-in-water formulation for intravenous use. Long-term propofol sedation has been associated with hypertriglyceridemia [4-6].Dexmedetomidine, a highly selective alpha-2-receptor agonist, has been recently introduced for sedation in the ICU setting. It combines analgesic, sedative, and anxiolytic effects while maintaining patient reusability without significant respiratory depression [7].The results of laboratory and clinical studies showed that Dexmedetomidine reduces inflammatory responses and animal studies also showed inhibition of pro-inflammatory cytokines [8].Propofol is highly lipophilic and formulated in a 10% oil-in water lipid emulsion. The lipid component is based in soyabean oil and contains triglycerides, phospholipids, glycerol, vitamins, and minerals. The primary lipid is linoleic acid, an omega-6 long-chain polyunsaturated fatty acid. Due to its formulation, propofol has been associated with an increased risk of developing hypertriglyceridemia [9-10]

Aims & Objective: Objectives of this study was to determine the effect of propofol and dexmedetomidine on lipid profile in ICU patients.

Materials and Methods

This was a cross sectional hospital based study conducted in the department of anaesthesia, in a tertiary care hospital, India. All patients admitted in intensive care unit in our hospital requiring sedation and mechanical ventilation was enrolled in this study. A total of 100 patients divided into 2 groups 50 in each.

Group A: Received propofol infusion(1-1.5 mg/kg followed by 50-75mcg/kg/min) as a sedation for 12 hours

Group B: Received dexmedetomidine infusion (1 mcg/kg over 10 minutes followed by 0.4-0.7 mcg/kg/min)as a sedation for 12 hours

The study groups included both surgical and medical patients

Inclusion criteria:

- Patients aged between 18 to 80 years with both gender.
- Patients who requiring sedation or anaesthesia
- Participant's attendants who provide written informed consent

Exclusion criteria:

- Patients aged between <18 or >80 years.
- Pregnant females, severe hepatic, renal, or CNS involvement, significant arrhythmias or high degree of atrioventricular nodal block
- Patients who had allergies to these drug
- Participant'sattendantswho does not provide written informed consent

Demographic data (age, sex, and BMI) and duration of anesthesia and surgery were recorded. Patients' hemodynamic parameters, including heart rate (HR) and MAP were recorded during the following stages of the study: pre-induction, induction time, and intra-operatively every 10 min till the end of anesthesia.

Before and after each surgery, blood samples were obtained, and plasma was prepared. Lipid profile (serum total cholesterol, triglycerides, HDL and LDL), total bilirubin, serum protein, AST, ALT, serum urea, creatinine, random blood sugar and all relevant investigation was done.

Statistical Analysis: Mean and Standard Deviation (SD) were presented as descriptive statistics. Dichotomous outcomes were compared using Chi-square test. Student's t-test was used to compare numerical variables. Intra group comparison was done using analysis of variance (ANOVA). Analysis was done using SPSS VERSION 22. The result were considered significant when p-value was <0.05.

Results

A total of 100 ICU admitted patients were enrolled and analysed in the present study. We have divided all patients into propofol and dexmedetomidine infusion group. The socio- demographic profiles, baseline vital parameters and baseline laboratory investigations of both the groups were comparable.

Table 1: Comparisons of socio-demographics and clinical characteristics among propofol and dexmedetomidine infusion patients

Variables (Mean ± SD)	Propofol group	Dexmedetomidine group	P value
Age in years	55.3 ± 7.6	58.7 ± 8.2	0.034
Male	27	30	0.544
Female	23	20	
Height(cm)	164.5 ± 6.15	166.64 ± 5.58	0.071
BMI	25.27 ± 3.16	22.67 ± 1.89	0.01
Weight (kg)	68.9 ± 5.43	70.88 ± 6.52	0.102
Surgery duration (minutes)	55.43 ± 6.25	58.42 ± 7.85	0.037
Duration of sedation infusion in ICU (h)	12.3 ± 1.9	10.6 ± 1.5	0.048
Time recovery of consciousness (h)	1.3 ± 0.5	1.6 ± 0.5	0.003
Length of stay in the ICU (h)	41.7 ± 4.4	44.1±4.9	0.011

The comparison of baseline parameters of in two groups with values obtained subsequently lead to following observations. It revealed statistically significant difference in heart rate (HR) and mean arterial blood pressure after loading dose ($p<0.05$) and at all times during sedation ($p<0.05$) in Group A (propofol) patients and Group B (dexmedetomidine)

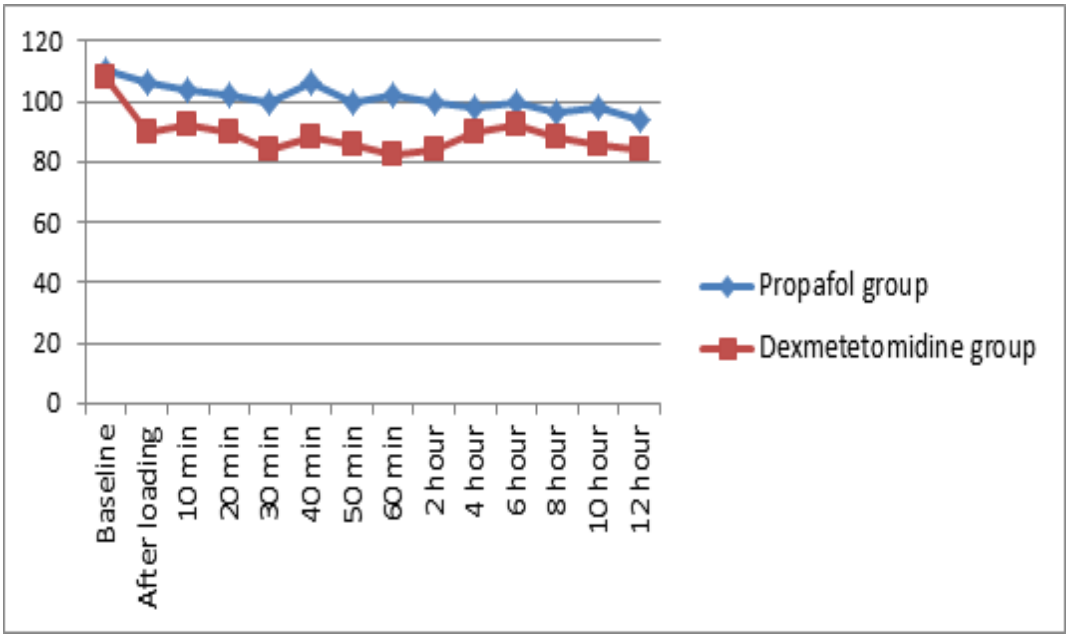

Figure 1: Mean heart rate at different time interval in propofol and dexmedetomidine group

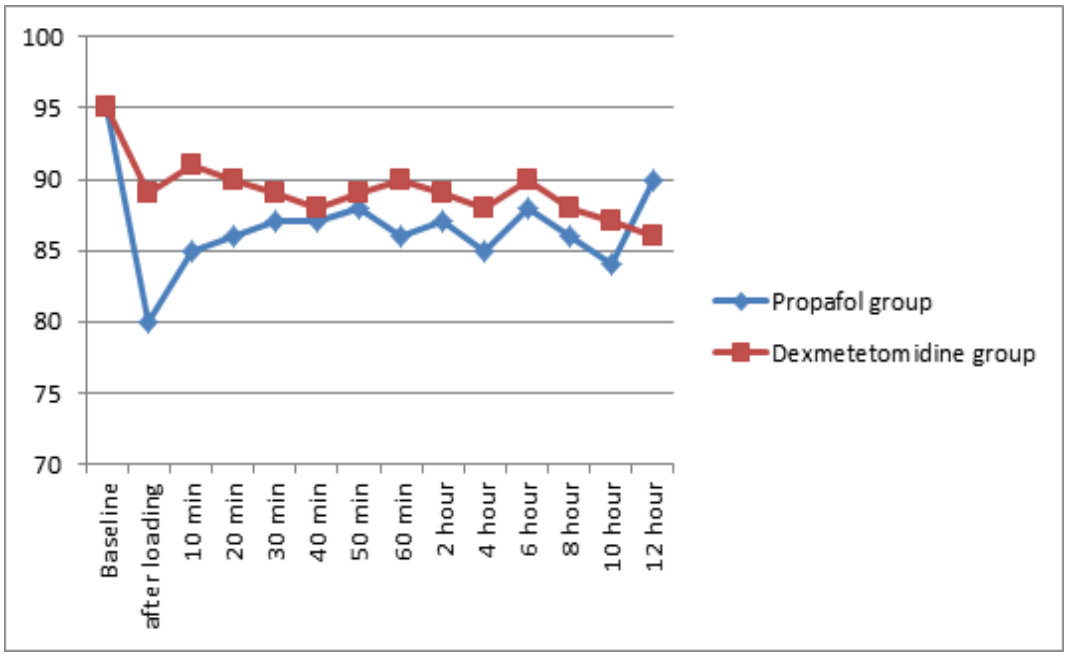

Figure 2: Mean blood pressure at different time interval in propofol and dexmedetomidine group

Lipid profile (total cholesterol, triglyceride, HDL and LDL) was statistically significant differ in the propofol and dexmedetomidine group patients ($p<0.05$).

Table 2: Comparisons of lipid profile among propofol and dexmedetomidine infusion patients

Lipid profile (Mean±SD)	Propofol group	Dexmedetomidine group	P value
Total Cholesterol	246.7 ± 24.42	195.6 ± 21.61	P < 0.001
Triglyceride	225±10.36	139 ± 9.89	P < 0.001
HDL-C	47.48±3.61	50.12±4.00	P = 0.008
LDL-C	148.04±20.16	97.65±18.61	P < 0.001

Biochemical parameters like: serum protein, total bilirubin, serum creatinine, AST, ALT and random blood sugar was significantly differ in propofol and dexmedetomidine group patients ($p<0.05$)

Table 3: Comparisons of biochemical laboratory parameters among propofol and dexmedetomidine infusion patients

Biochemical laboratory parameters	Propofol group (Mean±SD)	Dexmedetomidine group (Mean±SD)	P value
Protein (mg/ml)	0.14±0.02	0.10±0.04	P < 0.001
ALT (IU/L)	400±15.4	328±10.7	P < 0.001
AST(IU/L)	505±28.9	565.8±20.5	P < 0.001
Total Bilirubin (µmol/L)	8.0±0.51	7.25±0.76	P < 0.001
Urea (µmol/L)	32.5±6.1	30.3±5.75	P = 0.065
Creatinine (µmol/L)	7.50±0.21	6.01±0.62	P < 0.001
RBS (mmol/L)	6.2±0.63	6.8±0.21	P < 0.001

Discussion

Sedation forms an integral component of bedside care for patients in the intensive care unit (ICU). Inadequate sedation techniques may have an adverse impact on the morbidity and mortality in ICU. In fact the monitoring of depth of sedation has currently been considered as an emerging standard of care [11]. The role of propofol and dexmedetomidine for postoperative sedation and analgesia in patients requiring mechanical ventilation is now well-established; however, most of the patients studied have been elective surgical patients with few co morbidities admitted in intensive care unit [12].

In our study patients age group difference was statistically significant ($p<0.05$) among dexmedetomidine and propofol infusion patients, dexmedetomidine group patients comprises older age as compared to propofol group, concordance findings also reported by Corrado et al [13].

The length of ICU stay was significantly longer in dexmedetomidine group as compared to propofol group, in agreement with the Y. Shehabi et al [14].

Significantly longer duration of sedation with propofol infusion group was observed in current study, in agreement with the, Venn RM et al [15].

The baseline means HR was similar in both the groups. However, after loading dose, there was statistically significant (p-value <0.05) decrease in heart rate in dexmedetomidine group compared to propofol group, similar results were found by Esmaoglu A et al [16] and Srivastava et al [17]. Decrease in HR can be attributed to sympatholytic and analgesic effects of dexmedetomidine.

We observed statistically significant fall in MAP following loading dose in propofol group. This observation was similar to Weinbroum AA et al [18]., who observed that 68% of patients receiving propofol ($p < 0.001$) had more than 20% decrease in systolic blood pressure after the loading dose, and B Paliwal et al [19], also observed reduction in MAP after propofol administration although the magnitude of fall in MAP was less.

Various biochemical and hematological parameters difference was reported between both the group. After the end of the surgery, the mean blood glucose in the patients receiving propofol was significantly lower than that in the dexmedetomidine group, accordance to Ghomeishi A et al [20].

Present study shows that the levels of serum total cholesterol, triglycerides, and LDL-cholesterol were significantly ($P< 0.05$) increased and serum HDL-cholesterol was significantly decreases following administration of propofol as compared to dexmedetomidine , similar finding reported by L. Ashakumari, et al [21] and W. F. Riesen, et al [22]. Increased triglycerides levels may be due to the increased availability of free fatty acid, glycerophosphates, decreased triglycerides lipase activity, or decreased fatty oxidation.

Among biochemical parameters serum protein, total bilirubin, alanine and aspartate amino transferases (ALT and AST), and creatinine levels were significantly ($P> 0.05$) affected with administration of propofol as compared to dexmedetomidine, our results correlate with the many other studies: Oluwatosin A, et al [23], Wu F, et al [24] and R. Rej, et al [25].

Conclusion

We conclude that adequate level of sedation can be achieved by both dexmedetomidine and propofol. Propofol elicited a detrimental effect on the lipid profile resulting in hypercholesterolemia which subsequently leads to abnormally high activities of serum protein, total bilirubin, alanine and aspartate amino-transferases (ALT and AST) and serum creatinine.

Dexmedetomidine appears a safe and potential effective sedative agent in critically ill ICU patients as compared to propofol.

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