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PSYCHOMOTOR RECOVERY OF DEXMEDETOMIDINE COMPARED WITH PROPOFOL AFTER SEDATION DURING SPINAL ANESTHESIA: A RANDOMIZED CONTROL TRIAL

Anaesthesiology

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ABSTRACT

Background- We planned to investigate the time and quality of psychomotor recovery of dexmedetomidine in comparison with propofol for intraoperative sedation for surgeries requiring spinal anesthesia

Methods- 100 patients were included. Group D received dexmedetomidine 0.5 μg/kg (loading dose) followed by 0.2–1 μg/kg/hour. Group P received propofol infusion of 25–100 μg/kg/minute. Psychomotor recovery was assessed by finger-tapping, manual dexterity, visual spatial memory capacity, and pen and paper tests. Psychomotor tasks were given to the patients postoperatively at every 30 minutes for 2 hours followed by every hour up to 4 hours after surgery.

Results- The primary objective was to assess psychomotor recovery in which impairment was seen in both groups up to 1 hour. The motor recovery using finger tapping test was faster in Group D than Group *P* (72.12 ± 41.24 *vs* 101.24 ± 37.24 min, *P*–value = 0.01). Motor recovery using peg board test was faster in Group *P* than Group D. Visual spatial capacity memory test and pen and paper tests were unaffected (*P*–value = 1.00) and patients of both groups reached the baseline values in 30 minutes

Conclusion- We conclude that dexmedetomidine is superior to propofol in terms of psychomotor recovery as seen on finger tapping test, which is a better predictor of various daily activities, even though other tests were comparable between both the groups. Thus, dexmedetomidine may prove to be a better sedative agent than propofol for spinal anesthesia in providing a complete psychomotor recovery and helps in fast track discharge of the patient

KEYWORDS

Dexmedetomidine, Propofol, Psychomotor.

INTRODUCTION

Psychomotor function has been evaluated by a wide variety of tests with the most commonly used being pen and pencil test like Trieger dot test (TDT) and digit symbol substitution test (DSST). Recovery of psychomotor function assessed by these tests indicates the recovery from anaesthesia.[1]

Dexmedetomidine has analgesic and sedative properties which does not cause respiratory depression. Hypoxic and hypercapnic ventilator drives are also preserved with this drug. Propofol is known to cause impaired cognitive, coordination, and reactive skills on which dexmedetomidine has a little effect. Dexmedetomidine has a unique property of sedation that it does not cause respiratory depression even with higher doses. However, higher doses of dexmedetomidine can cause reduced attention and mental slowness and little is known about the effects of dexmedetomidine on psychomotor function.[2] Hence, we planned to investigate the time and quality of psychomotor recovery of dexmedetomidine in comparison with propofol for intraoperative sedation for surgeries requiring spinal anesthesia.

MATERIAL AND METHOD

Study design:

Hospital based Randomized, Double Blind, Interventional study.

Randomization:

It is a statistical procedure by which the participants were allocated into two different groups.

In this study randomization was done by sealed envelope. A total of 100 sealed envelopes (50 per group) were made, each sealed envelope mentioning a particular study group. One of my colleagues asked the patient to pick up a sealed envelope from the box. Patient were allocated to group mentioned on the sealed envelope. Study drug was prepared by my colleague and was administered by me to the patient.

Double blinding:

This trial was so planned that the doctor who prepared and injected anaesthetic agent was different from the doctor who observed the study participants and observed data. The syringe was wrapped with white paper.

The patients were told that some anaesthetic agent would be given, but type of anaesthetic agent were not disclosed to them.

Study Group:-

The study was conducted on 100 patients divided in two groups of patients. Each group consisted of 50 patients.

- Group D(n=50) – Dexmedetomidine group 0.5 μg/kg (loading dose) followed by 0.2–1 μg/kg/hour.
- Group P(n=50) – Propofol group ,given as infusion of 25-100 μg/kg/minute

PAC :-After taking Ethical committee approval ,all the patients were preanesthetically evaluated by taking history ,Systemic examination of CVS,CNS ans RESP and investigation were performed and ASA grading was labelled

INCLUSION CRITERIA:-

- Patients aged 18-60yrs
- Patient height >145 cm.
- Patient's body weight 40-80 kg.
- ASA grade I-II.
- We included patients who were scheduled for elective lower abdominal, urological, gynecological, and orthopedic surgeries under spinal anesthesia.

EXCLUSION CRITERIA:-

- Patient Refusal
- Patients with history of bleeding disorders or patients on anticoagulants, Platelet<75,000.
- Spinal deformity or infection at the local site.
- Patient allergic to Local Anaesthetic drug
- Failed spinal block
- Pregnant women.

A battery of four tests was used to assess psychomotor recovery and base line scores of each test were recorded the day before the surgery after giving practice sessions to accustom themselves. Final attempt after four practice sessions was taken as baseline value.

Manual dexterity test was used to assess coordination, that is, the ability to make skillful, arm-hand manipulations of smaller and larger objects mainly involving gross motor activity and hand dexterity. This manual dexterity was assessed using Purdue peg board test. This test, which involved assembling of pins in holes on a board in a 30-second period with two hands separately and placing pins, washer, and collar all together, called as an assembly on a board in 1 minute that was calculated as the mean score.[3] This test took about 5 minutes.

Finger tapping test was done with a special tapper and counter, where the patient was required to tap, using the index finger of the hand for a 10-second period. Five trials of 30 seconds for each hand were conducted, and mean score was taken from the five tapping times. It was mainly used to assess fine motor function associated with skills of hand. It took a total duration of 10 minutes for assessment.[4,5]

Visual spatial capacity memory test: Visual spatial capacity memory test was used to assess memory of recall. In this test, patients were given a sample of coloured squares. For each time, patients were asked to see a display of coloured squares on a computer screen and needed to remember them. Patients were expected to notice the change after the colored squares disappeared and reappeared after some time with color changes and give an answer Yes/No. We presented test arrays to the patients with different sets of papers with the change of coloured diagrams instead of automated array presentations to suit the Indian rural population as they were unaccustomed to computer tasks. This task took about 2–5 minutes.[6]

Pen and paper test (for Indian rural population): This pen and paper test was simplified into a six-point questionnaire testing orientation of a person to time, place, and season. Attention and concentration by serial subtraction of 7 starting from 100; registering three objects, and naming them after 1 minute; execution of a function such as folding a paper into half, construction of a diagram such as a pentagon, and recall of the abovementioned objects at the end. It took about 5 minutes and was an important test for cognition. The time duration for all tests was 20 minutes[7].

Procedure- After checking vitals patient was taken in OT and all monitoring were connected.Spinal anesthesia was performed after preloading with intravenous crystalloids 10 mL/kg and bupivacaine of 2.8 cc volume was used as a standard in all patients, and after the fixation of spinal anesthesia Group D patients received intravenous (IV). Dexmedetomidine 0.5 μg/kg loading dose for 15 minute followed by a maintenance dose of 0.2–1 μg/kg/hour[8] as infusion via a three-way cannula attached till the end of the surgery. Sedation was assessed using Ramsay sedation scale (RSS) at the time of incision and then every 30 minutes until the end of the surgery. The dexmedet omidine infusion was adjusted with incremental doses of 0.2 μg/ kg until the target RSS score of 3–4 was achieved and the patient could respond to commands or to light glabellar tap and also titrated to maintain stable hemodynamic parameters throughout the surgery.

Group *P* patients received propofol 25–100 μg/kg/minute and the infusion rate was also adjusted with incremental doses of 10 μg/kg/minute to maintain the level of sedation to RSS values 3–4. Oxygen was administered with a face mask at 5 L/minute only when the pulse oximetry reading was falling below 95%. Hypotension defined as a decrease in systolic blood pressure by >20% from baseline or <90 mm Hg was treated with IV doses of mephentermine 3 mg and further boluses of IV fluid as required. Bradycardia defined as heart rate (HR) <50 bpm and was treated with IV atropine 0.6 mg. Loading dose of dexmedetomidine was not started if systolic blood pressure was <90 mm Hg, whereas maintenance infusion was continued with lower doses during the episodes of hypotension and bradycardia in both the groups as they were treated promptly and sedation was stopped only at the time of skin closure

RESULTS

Table 1. Demographics profile

Variable	Group-D	Group-P	P-Value
Age in Yrs	52.04±6.02	51.35±7.05	>0.05
ASA(I:II)	42:8	43:7	>0.05

Both groups were comparable.

Table 2: Recovery of Psychomotor function (Mean time to reach baseline value)

Psychomotor tests		Group-D	Group-P	P-Value
Peg board test	Right hand	99.23±43.25	87.26±40.12	0.098
	Left hand	64.23±41.23	64.89±47.25	0.214
Finger tapping test	Right hand	72.12±41.24	101.24±37.24	0.01
	Left hand	64.84±49.24	104.24±43.21	0.01
Visual spatial test		30.00±0.00	30.00±0.00	1.00
Pen & paper test		30.00±0.00	30.00±0.00	1.00

The primary objective was to assess psychomotor recovery in which impairment was seen in both groups up to 1 hour. The motor recovery using finger tapping test was faster in Group D than Group P (72.12 ± 41.24 vs 101.24 ± 37.24 min, P–value = 0.01). Motor recovery using peg board test was faster in Group P than Group D. Visual spatial capacity memory test and pen and paper tests were unaffected (P–value = 1.00) and patients of both groups reached the baseline values in 30 minutes

Table 3. Maximum sensory block

Maximum sensory level	Group-D	Group-P	P-Value
T4-6	8	19	0.09
T7-10	40	31	
>T10	2	0	

Maximum sensory level of anesthesia was also comparable

DISCUSSION

In our study, we have observed that patients in dexmedetomidine group had significantly earlier psychomotor recovery compared with propofol. Dexmedetomidine group performed statistically significantly better in the psychomotor tests($p<0.05$) such as finger tapping 60 minutes following anesthesia in comparison with propofol group. Though there was delayed recovery in hand dexterity with Purdue peg board in dexmedetomidine group and it was not statistically significant similar to the study conducted by Perika T and colleagues (2019)

In our study, free recall was unimpaired, with complete preservation of recognition recall with visual spatial memory task for all patients irrespective of the anesthetic agent used. Recovery was noted within 30 minutes for visuospatial capacity memory test and pen and paper test.

Dexmedetomidine is a selective α-2 receptor agonist with a sedative, anxiolytic, and analgesic effect, which does not cause respiratory depression.[9] Dexmedetomidine causes the "natural sleep" through inhibition of neuronal firing in the locus coeruleus in the brainstem, which means the patient is easily arousable on verbal stimulation without impaired cognitive abilities and psychomotor functions.[10] Although dexmedetomidine is in use for intraoperative sedation, there is limited information about its psychomotor recovery after surgery.[11,12]

Propofol's actions are generated by enhanced γ-aminobutyric acid suppression at cortical and thalamic interneurons and it can decrease basal ganglia activity causing diminished finger movements and automatic finger movement sequencing.[13] These rhythmic finger movements were diminished in the propofol group of our study. Propofol also impedes the blood flow regionally to the thalamocortical, basal ganglia circuits even at low doses, which are essential for the rhythmic motor activity.[14] All the above can be the reasons for subjects of propofol group performing poorly when tested with finger tapping test compared with Dexmedetomidine which involves locus coeruleus and acts through endogenous NREM sleep circuits and has no effect on basal ganglia.[15]

CONCLUSION

We conclude that dexmedetomidine is superior to propofol in terms of psychomotor recovery as seen on finger tapping test, which is a better predictor of various daily activities, even though other tests were comparable between both the groups. Thus, dexmedetomidine may prove to be a better sedative agent than propofol for spinal anesthesia in providing a complete psychomotor recovery and helps in fast track discharge of the patient

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