



COMPARISON OF COMBINATION OF ANAESTHETIC AGENTS FOR MOTOR EVOKED POTENTIAL MONITORING

Anaesthesiology

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ABSTRACT

We aimed to find out if addition of ketamine to the propofol-fentanyl-dexmedetomidine combination reduces the dose of all the drugs maintaining constant level of anesthesia and producing minimum effects on Transcranial Motor Evoked Potentials (MEP). It was a double-blind, prospective randomized controlled trial. A total of 60 patients, with ASA class I - III, undergoing spinal surgery under general anesthesia were enrolled and randomly divided into two groups; Group P received Oxygen + Nitrous oxide + Propofol + Fentanyl + dexmedetomidine infusion and group KP received ketamine infusion in addition to the above anesthesia technique. comparison of dose requirement of all the drugs were made between group P and Group K with out any fall in MEP. Mean of doses of drugs required in both the groups were calculated of all the drugs separately and compared in both the groups. SPSS 20.0 statistical system was used. Data was analyzed using student's independent 't' test and chi-square test. In group P, mean of total dose of propofol used was 4.00 ± 0.85 whereas in group KP, it was 2.23 ± 0.70 . Similarly in group P, mean of dose of dexmedetomidine used was 0.56 ± 0.27 whereas in group KP it was only 0.22 ± 0.10 . In group P, mean of total dose of fentanyl used was 1.72 ± 0.42 on the other hand it was 1.02 ± 0.42 in group KP. On intergroup comparison, all these dose differences were found to be statistically significant. (P value < 0.001). Postoperatively recovery of patients were compared in both the groups and it was found that on intergroup comparison this difference was insignificant statistically. (P value of 0.301). Therefore it can be concluded that use of ketamine in small doses is better in terms of total requirement of all the other anaesthetic agents, when used as an infusion in patients undergoing spinal surgery without any effect on postoperative recovery.

KEYWORDS

motor evoked potentials, propofol, dexmedetomidine, fentanyl.

Introduction :

Neurological functions in an anesthetized patient can be monitored either by electroencephalography or by evoked potentials. The goal of evoked potential is to identify changes in the nervous system function prior to irreversible damage.[1]

Anaesthetic agents have a dose dependent adverse effect on the ability to record evoked potential responses and can reduce the ability of evoked potential to detect compromised spinal function.[2] Reduced efficacy of neurologic monitoring might reduce the ability of surgeons to take corrective measures on time. Therefore, a poorly planned and executed anaesthetic management could render evoked potentials useless, and lead to poor outcome. Therefore, various authors are testing various anaesthetic techniques or combination of techniques with minimal effect on motor evoked potential.

Keeping in mind all the above factors we did a study to compare two combinations of various anaesthetic agents that have minimum effect on motor evoked potential amplitudes and depth of anaesthesia but at the same time reducing the dose of individual drugs significantly so that the side effects of various drugs and post-operative outcome can be improved and lastly avoiding the most frightening complications of spine surgery.

Materials and methods

Patients and groups:

A double-blind, prospective randomized controlled trial was performed after approval by the institute ethics committee. A total of 60 patients were randomly divided into two groups. Patients of either Sex, scheduled for elective spine surgical procedure, requiring orotracheal intubation, with neurology of at least ASIA-D and ASA Grade I - III. Patients with ASA grade IV and above and those with contraindications for MEP monitoring like Epilepsy, Cortical Lesion, Raised intracranial tension, Cardiac diseases, Intracranial electrodes, Vascular clips/shunts, Cardiac pacemakers were excluded from the study.

In Group P, patients received propofol, dexmedetomidine, fentanyl infusions along with oxygen and nitrous oxide. In group KP, in addition to the drugs in group P, patients also received ketamine infusion. Written informed consent was obtained from all the patients. Furthermore, all of the patients were blinded to the interventions.

Anesthesia technique:

On the day of surgery two wide bore intravenous lines were secured. Standard monitors including electrocardiography (ECG), pulse oximetry (SpO₂) and non-invasive blood pressure (NIBP) were attached. The same anaesthesia regimen was used for providing general anaesthesia in all patients. Injection Glycopyrrolate 0.005 mg/kg + Injection fentanyl 1 - 2 µg/kg was administered for premedication. Induction of anaesthesia was performed by injection propofol 1.5-2 mg/kg along with Nitrous oxide (N₂O) 50% + Oxygen (O₂) 50%. After ensuring adequate mask ventilation, muscle relaxation was facilitated by injection rocuronium 0.6 mg/kg. Mask ventilation was performed for 3 minutes until adequate muscle relaxation was achieved.

Intubation was done with the help of laryngoscope / truviv or awake intubation with fiberoptic bronchoscope as per the requirement of the patient. Correct placement of tube was confirmed with capnograph and bilaterally equal breath sounds. A soft bite block of appropriate size was placed and fixed to avoid tongue bite. Temperature probe was inserted in all the patients nasally. All electrodes for MEP and Bispectral Index monitoring were placed. All anaesthetics were discontinued for baseline readings.

Baseline reading

Base line transcranial motor evoked potentials were recorded on left and right side. The best baseline MEP recordings or the MEP reading of the muscle group likely to be least affected by surgical procedure was chosen for monitoring. After satisfactory MEP (response), anaesthetic agents (according to the study groups) were started for maintenance of anaesthesia and patient positioning was made as per our protocol. Also baseline readings of heart rate and mean arterial

pressure were recorded.

Anesthesia maintenance:

In group P, Injection Propofol infusion @ 50-150µg/kg/min + fentanyl infusion @ 1-3µg/kg/hr + dexmedetomidine 0.5 - 0.8 µg/kg was injected over 30 minutes and pumped at 0.1- 1.0 µg/kg/hr with O₂ (50%) + N₂O(50%).

In group KP, anesthesia was maintained using Injection Propofol infusion @ 50-150µg/kg/min + fentanyl infusion @ 1-3µg/kg/hr + dexmedetomidine 0.5 - 0.8 µg/kg injected over 30 minutes and pumped at 0.1- 1.0 µg/kg/hr + Ketamine 10-30µg/kg/min + O₂(50%) + N₂O(50%).

Additional drugs administered in group P were same as in group KP and no muscle relaxant was administered in either of the groups. All of the patients were subjected to controlled ventilation at frequency of 14 per minute. During surgery, the patient's end tidal carbon dioxide was maintained between 35 and 45 mm Hg and the bispectral index (BIS) was maintained between 50 and 60. MEP monitoring was done using the Medtronic® NIM – Eclipse™ system 68L2128 neuro-physiological detector. The stimulus intensity was kept between 200 and 350 V. The MEPs were recorded simultaneously from muscles bilaterally. After recording baseline MEP bilaterally and starting infusions of drugs at lower side of the dose range five readings of left and right side were taken at the interval of 30 min simultaneously, keeping rest of the factors constant (BIS, voltage, temperature). Taking care of the MEP monitoring comparison of dose requirement of propofol, fentanyl and dexmedetomidine were made between group P and Group KP with out any fall in MEP or changes in other factors that were kept constant. Mean of doses of drugs required in both the groups were calculated for all the drugs separately and compared in both the groups.

All the data was filled in a printed format for further analysis by SPSS 20.0 statistical system. Descriptive statistics of quantitative data was presented as mean and standard deviation. Continuous normally distributed data was analyzed using student's independent 't' test and chi-square test. For all comparisons a probability of 5% was considered as significant.

Results :

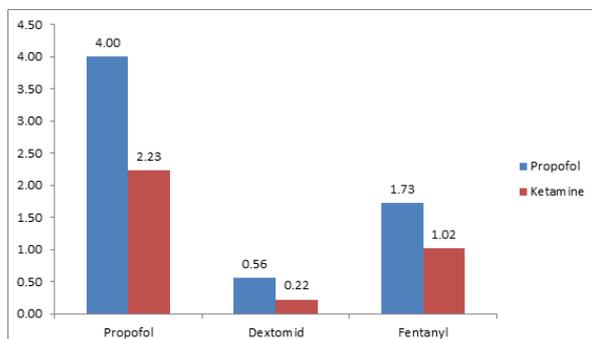
60 patients were included and following observations were made. Surgeries in most of the cases included scoliosis correction, posterior stabilization and decompression surgery in spinal cord injuries or tumor excision etc.

Table 1: Comparison in drug requirement among two groups

Variable	Group	Mean	P value
Propofol	Propofol	4.00±0.85	<0.001
	Propofol+Ketamine	2.23±0.70	
Dextmedetomidine	Propofol	0.56±0.27	<0.001
	Propofol+Ketamine	0.22±0.10	
Fentanyl	Propofol	1.72±0.42	<0.001
	Propofol+Ketamine	1.02±0.42	

On individual intergroup comparison of all these drug, dose differences were found to be statistically significant. (P value < 0.001).

Graph 1: showing comparison of total dose requirement of all drugs separately in two groups



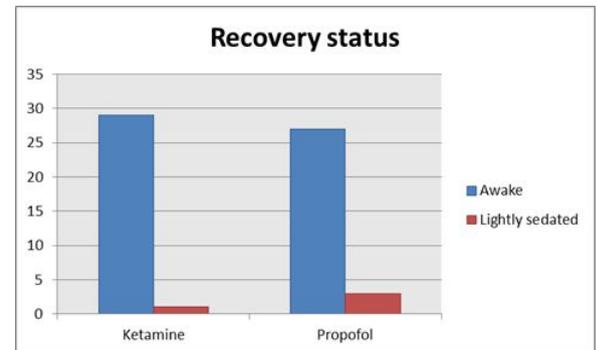
Postoperatively recovery of patients were compared in both the groups

and it was found that out of 30 patients in group P, three patients were lightly sedated whereas in group KP, only one patient was lightly sedated. But on intergroup comparison this difference was insignificant statistically. (P value of 0.301).

Table 2: Recovery status

	Group KP	Group P	Total
Awake	29 (96.7%)	27 (90%)	56 (93.3%)
Sedated	1 (3.3%)	3 (10%)	4 (6.7%)
Total	30 (100%)	30 (100%)	60 (100%)

Graph 2: Comparison of recovery of patients postoperatively in both groups



Discussion :

The aim of this study was to evaluate the requirement of different doses of dexmedetomidine, propofol, fentanyl and postoperative recovery after addition of ketamine to the combination during intraoperative motor evoked potential (MEP) monitoring in patients undergoing spine surgeries keeping depth of anaesthesia constant.

In a case report Rozanna Penney et al, demonstrated that successful intraoperative neurologic monitoring can be performed using dexmedetomidine, ketamine, and fentanyl infusions plus nitrous oxide. As demonstrated in a few studies, dexmedetomidine has minimal affect on evoked potentials and ketamine enhances MEP signals. Both drugs have substantial analgesic properties, possibly decreasing postoperative narcotic requirements. In our study addition of ketamine in group KP, significantly reduced the requirement of fentanyl and dexmedetomidine. (P value < 0.001). [3]

By using bispectral index monitoring and simultaneous clinical sedation scoring (modified Ramsay Sedation Scale [range 1 to 8; 1=alert, 8=unresponsive]), it was found that out of 30 patients in group P, three patients were lightly sedated whereas in group KP, only one patient was lightly sedated although this difference was statistically insignificant. [4]

Z. Chen et al did a study using different doses of dexmedetomidine during spine surgery and concluded that dexmedetomidine did not affect somatosensory evoked potentials of senile patients, but inhibited MEPs when larger doses were administered, in our study in group P, we used small dose of dexmedetomidine (0.56±0.27) which was further reduced in group K after addition of ketamine (0.22 ± 0.10). [5]

Frei et al did a study in 108 children and concluded that combining spatial facilitation with a transcranial electrical stimulation (TES) protocol improved monitoring of corticospinal motor pathways during spinal surgery in children. A ketamine-based anesthetic technique was preferred in children <6 years of age. [6]

Agrawal R et al described a patient who underwent spine fusion surgeries twice and concluded that when ketamine-based anaesthetic was used for the second surgery sensory evoked potentials were easily monitored. [7]

Sengupta S et al that low dose 0.2mg/kg ketamine did not increase the BIS and BIS could be maintained within anaesthesia level however ketamine 0.5mg/kg caused to increase BIS from 40 to 63. We gave ketamine at low dose which did not alter the BIS level. [8]

Riham Hasanein et al compared ketamine:propofol (in 1:4 ratio) vs fentanyl:propofol for sedation for ERCP in obese patients and found

that the dose of propofol requirement in fentanyl:propofol group was significantly higher than that in ketamine:propofol group. Similar results were obtained in our study and it was found that addition of ketamine in small dose to the combination reduced doses of other drugs significantly.[9]

Simin Atashkhoyi et al used low-dose ketamine with propofol-fentanyl anaesthesia in patients undergoing diagnostic gynaecological laparoscopy (DGL) and concluded that use of low-dose ketamine with propofol-fentanyl anaesthesia in patients undergoing DGL was associated with less pain during propofol injection, lower incidence of haemodynamic changes, lower total dose of propofol and improved postoperative analgesia.[10]

Conclusion :

The use of ketamine in small doses along with propofol-dexmedetomidine – fentanyl combination is better in terms of total dose requirement of all the other three anaesthetic agents, when used as an infusion in patients undergoing spinal surgery without any significant effect on postoperative recovery.

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