International Journal Dental and Medical Sciences Research (IJDMSR)
ISSN: 2393-073X Volume 4, Issue 12 (December - 2020), PP 25-32
www.ijdmsr.com

Effect of Dexmedetomidine Vs Sevoflurane on Motor and Somatosensory Evoked Potential in Lumbar Spinal Cord Tumor Resection; A Randomised Comparative Observational Study

[1]Dr. Parikh Tapan Parimal, [2]Dr. Manisha S. Kapdi
[1]*(Ex Resident, SVP Hospital, Vadodara)*
[2]*(Associate Professor, SVP Hospital, Ahmedabad)*
**Corresponding Author: Dr. Manisha S Kapdi*

ABSTRACT
BACKGROUND: We are here to compare the effect of the inhalational agent (Sevoflurane) at MAC 1.5 vs Dexmedetomidine with a loading dose 1mcg/kg/hr for 10 minutes followed by 0.5 mcg/kg/hr by an infusion pump in addition to a fixed dose of propofol based anesthesia regimen on Motor Evoked Potential (MEP) and Somatosensory Evoked Potential (SSEP) in case of elective Lumbar Spinal Cord Tumor Resection surgery.
METHOD: This was a randomized comparative observational study and forty patients were randomized into two groups in which the investigator and patient were blinded, but anesthetist cannot be blinded. All patients were ASA grade I-II between 30-60 years.
Group DP: Intraoperative Maintenance of Anesthesia was given with i.v. Dexmedetomidine at 0.5mcg/kg/hr after loading dose of 1mcg/kg over 10minutes by Infusion pump along with Propofol at 100mcg/kg/min
Group SP: Intraoperative Maintenance of Anesthesia was maintained with Inhalational Sevoflurance keeping Mean Alveolar Concentration (MAC) 1.5 along with Propofol infusion at 100mcg/kg/min.
Inj.Normal Saline was started by an infusion pump in Group SP as control.
Inj. Fentanyl was given at 50 mcg/hr intraoperatively in both groups
Result: The two groups of patients had no significant differences in vitals, demographic data and preoperative power of both the lower limbs ($P>0.05$), but intraoperative studies suggested that Sevoflurane does affect Motor and Somatosensory Evoked Potential leading to a decrease in amplitude and increase in latency as compared to iv Dexmedetomidine ($P<0.05$)
Conclusion: Dexmedetomidine had no significant change while Sevoflurane leads to a decrease in amplitude and an increase in latency of Motor and Somatosensory Evoked Potential in Lumbar Spinal Cord Tumor Resection.

Keywords: Dexmedetomidine, Sevoflurane, MEP, SSEP, Lumbar Spinal Cord Tumor

I. INTRODUCTION

Motor Evoked Potential (MEP) and Somatosensory Evoked Potential (SSEP) are widely used during spinal cord surgeries. "SSEP assess the integrity of sensory pathways that traverse the spinal cord in areas of risk for injury"[1]. Tibial SSEPs are monitored in Lumbar spinal cord tumors. Conduction pathway of the SSEPs is the dorsal column. MEP are recorded from distal muscles (Tibialis anterior and Abductor Hallucis longis) for the lower extremities. MEP recordings are done in the lateral columns of the spinal cord, and their blood supply would be affected by perfusion loss of the anterior spinal artery. Most commonly used stimulation technique is Transcranial electrical stimulation (TcMEP) [2, 3].

MEP and SSEP are affected by anesthetic agents in a dose-dependent manner [4, 5, 6]. "Dexmedetomidine is a selective alpha-2 agonist. It has the effect of sedation, analgesia, sympatholytic, minimal respiratory depression, and possible neuroprotection"[7-9].

"All halogenated inhalational agents produce a dose-related increase in latency and reduction in the amplitude of cortically recorded SSEPs [10, 11] and MEPs". This was due to a lesser degree of the neuromuscular blockade [12]. Keeping the concentration of the volatile anesthetic to less than 0.5 MAC will help acquire acceptable MEPs [11].
"Nitrous oxide (N_2O) decreases amplitude of cortical SSEP but increases latency if used alone or when combined with opioids, halogenated inhalational agents, or propofol"[12,14,15].

Injection Propofol is used for the induction and maintenance of general anesthesia. Dose of 100 mcg/kg/min is used for maintenance of anesthesia. "Propofol produces a dose-dependent reduction in the amplitude of MEPs but has no effect on the latency" [16].

Fentanyl has a limited effect on MEPs. In this study, we propose our hypothesis that the Propofol-Dexmedetomidine combination does not exert an adverse effect on MEP and SSEP monitoring in patients with Lumbar spinal cord tumors while Sevoflurane with Propofol markedly reduces the amplitude and prolong latency of MEP and SSEP.

II. MATERIALS AND METHODS

The prospective double-blind randomized, single-centre, comparative observational study composed of 20 patients in each group were selected of ASA grade I and II of age 30-60 years undergoing elective surgeries. The patients were selected with Mallampatti grade I/II. Surgery was done in a prone position. The procedure was explained and consent was taken.

Exclusion criteria:

- MEP Contraindications: Epilepsy, cortical lesions, skull defects, Raised intracranial pressure, Implanted intracranial devices, cardiac pacemakers or other implanted pumps
- Altered Hepatic and Renal Function Test
- Diabetes Mellitus
- Alcohol abuse, obese (BMI $\geq$ 30 kg/m^2)
- Anemia (Hemoglobin < 11 g/dl)
- Major organ dysfunctions

The patients were randomly assigned to a 1:1 ratio. The investigator and the patient were unknown to the anesthetic drug used. Since outcome was based on the result of electrophysiological monitoring, so the anesthetist cannot be blinded. Neurosurgeons and patients were blinded to the study group until the study was finished.

1. All patients were kept fasting overnight
2. I.V. line was secured and
3. Individuals were randomly divided into Group DP and Group SP. Written informed consent was obtained from all participants.

Group DP: Intraoperative Maintenance of Anesthesia was given with i.v. Dexmedetomidine at 0.5mcg/kg/hr after loading dose of 1mcg/kg over 10minutes by infusion pump along with Propofol at 100mcg/kg/min
Group SP: Intraoperative Maintenance of Anesthesia was maintained with Inhalational Sevoflurance keeping Mean Alveolar Concentration (MAC) 1.5 along with Propofol infusion at 100mcg/kg/min.
Inj Normal Saline was started by an infusion pump as the control in Group SP.
Maintenance dose of propofol at 100mcg/kg/min was continued in both the groups and Inj Fentanyl 50 mcg/hr also was given in both groups.
Premedication with Inj Glycopyrrolate 0.2mg + Inj. Fentanyl 2mcg/kg was given 3 min before induction

- Induction: After Preoxygenation with O_2 for 3 minutes,

Inj. Propofol 120 mg iv
Inj. Rocuronium 0.6 mg/kg i.v
Intubation was done with oral cuffed tube number 7.0 in females and 8.0 in males and cuff inflated.
The patientThe patient was was kept on Controlled ventilation on Volume A/C mode of the ventilator. Anesthesia was maintained with 50% Oxygen plus 50% Air plus Sevoflurane 3% (concentration adjusted to keep MAC 1.5) and Inj. Dexmedetomidine 0.5mcg/kg/hr in group SP and Group DP respectively.
Inj Propofol was started in both groups and maintained at 100mcg/kg/hr.
Inj Dexmedetomidine loading dose at 1mcg/kg for 10 minutes and Sevoflurane was started after half-hour of endotracheal intubation in Group DP and SP respectively after T1 reading.
Inj Propofol at 100mcg/kg/min was started in both groups after intubation.
Inj. Normal Saline was started in Group SP as control.
Inj Fentanyl 50mcg was repeated every hour for analgesia.
Routine ASA monitors, MEP, SSEP, Bispectral index (BIS), and intra-arterial blood pressure monitoring was done. Bradycardia, defined as the heart rate (HR) < 50 bpm, was treated with atropine (0.5 mg) bolus administration. Decrease of mean arterial pressure (MAP) >20% of the baseline was considered Hypotension, it was treated by dopamine infusion. Baseline blood pressure value was measured on preoperative evaluation on the day before surgery. BIS was maintained between 40-50.

More than Ninety percent recovery of the muscle strength on the basis of train-of-four ratio was deemed acceptable for the study. Measurements were taken with the patient in the prone position before skin incision to avoid the confounding effect of surgical stimulus on MEP and SSEP monitoring.

Muscle strength of the both lower limb extremities was assessed by the attending neurosurgeon who was blinded to the randomization and a 0-5 scale was used, with 5 indicating normal strength and 0 showing complete paralysis.
MEP and SSEP monitoring was done intraoperatively to avoid Neuro deficit postoperatively.
MEP and SSEP recordings were taken at different time intervals
T1: 30 minutes of endotracheal intubation after giving a prone position and before starting Dexmedetomidine infusion and Sevoflurane inhalational agent and before surgical incision, the recording was done at 100%O_2
T2: Time of Intraoperative MEP and SSEP monitoring before starting of Tumor resection with Sevoflurane MAC 1.5 and Dexmedetomidine infusion continued at 0.5 mcg/kg/hr after giving loading dose by infusion pump and 100%O_2.
T3: Time of MEP and SSEP recording after tumor resection with Sevoflurane MAC 1.5 and Dexmedetomidine infusion continued at 0.5 mcg/kg/hr and 100%O_2
Propofol infusion at 100mcg/kg/min was continued at all timing, T1, T2, T3
Inj Normal Saline was started in Group SP at T2 and T3 as a control
Decrease in amplitude by >50% and prolongation of the latency by >10% of both SSEP and MEP monitoring from the baseline values were defined as clinically meaningful changes [17]

At the end of the surgery, muscle relaxation was reversed with a combination of Neostigmine 0.05mg/kg and Glycopyrrolate 0.01mg/kg. Extubation was done with gentle oral suctioning, deflating full cuff and after all criteria of extubation were met and the patient was shifted to the Post anesthetist care unit.

Study Protocol and Statistical Analysis

Forty patients were required to detect significance, assuming a power of 80 % and a 2-sided α level of 5 %. 20 patients were recruited in each group. Quantitative data were analyzed for normal distribution. Normal distribution of Data was presented as the Mean ± SD. Data. It was compared and significance was obtained using t-Test using M.S. Excel 2007. Two sided P-values were taken, and the α level <0.05 was considered statistically significant.

Observations and Results

There were no significant differences of age, gender, weight, and height among both the groups **(Table 1)**. No significant differences in the muscle strength of the left and right lower extremities among both groups **(Table 2)**. No significant difference was seen in MAP, HR, BIS monitoring at different time points in both the groups **(Table 3)**. Significant difference was seen between both groups in MEP and SSEP monitoring at T2 and T3 timing with prolongation in latency and decreased in the amplitude of MEP and SSEP in Group SP as compared to Group DP **(Table 4)**

Table 1: Demographic Data of patients of both the groups no significant differences of age, sex, weight, and height among both the groups

Demographic Data				
Group	Age (yrs)	Sex (M/F)	Weight (Kg)	Height (cms)
DP (Dexmedetomidine-Propofol)	45 ± 5	12/7	66 ± 2	165 ± 2
SP (Sevoflurane-Propofol)	46 ± 4	11/9	65 ± 2	164 ± 2

Table 2: Comparison of power of lower extremity of both lower limbs before surgery
No significant differences in the muscle strength of the left and right lower extremities among both groups

Mean Lower Extremity Power before Surgery		
Group	Left	Right
DP (Dexmed-Propofol)	4.6	4.5
SP (Sevoflurane-Propofol)	4.7	4.6
P	>0.05	>0.05

Table 3: Vitals parameters of patients of both the groups showing MAP, HR and BIS
No significant difference was seen in MAP, HR, BIS monitoring at different time points in both the groups

Vital Monitoring			**Group DP (Dexmedetomidine + Propofol)**	**Group SP (Sevoflurane + Propofol)**
	MAP	Baseline	82.7 ± 2.27	84 ± 2.75
		T1	88.7 ± 2.27	87.4 ± 1.98
		T2	81.8 ± 2.23	81.5 ± 2.6
		T3	85.8 ± 2.23	81.4 ± 1.98
		P	>0.05	
	HR	Baseline	78.9 ± 7.9	78 ± 7.07
		T1	83.7 ± 7.37	85.2 ± 4.5
		T2	75.5 ± 6.7	76.9 ± 8
		T3	73.5 ± 6.6	72.8 ± 8.1
		P	>0.05	
	BIS	Baseline	44.2 ± 1.7	44 ± 1.3
		T1	43.7 ± 1.6	43.4 ± 1.9
		T2	41.7 ± 1.7	41.2 ± 1.8
		T3	42.4 ± 2.2	42.2 ± 1.9
		P	>0.05	

Table 4 & 5 Significant difference between both groups in MEP and SSEP monitoring at T2 and T3 timing with prolongation in latency and decreased in the amplitude of MEP and SSEP in Group SP as compared to Group DP

Table 4: Motor Evoked Potential recording at different time Intervals

Motor Evoked Potential				
		Groups		
Time	Measurement	DP	SP	*P*
T1	LLA (mv)	0.5 ± 0.06	0.4 ± 0.07	>0.05
	LLL (ms)	4.9 ± 0.15	4.9 ± 0.3	
	RLA (uv)	0.4 ± 0.04	0.4 ± 0.06	
	RLL (ms)	4.9 ± 0.2	4.7 ± 0.3	
T2	LLA (mv)	0.46 ± 0.07	0.3 ± 0.05	<0.05
	LLL (ms)	4.9 ± 0.16	5.2 ± 0.37	
	RLA (uv)	0.46 ± 0.05	0.28 ± 0.06	
	RLL (ms)	4.8 ± 0.2	5.05 ± 0.3	
T3	LLA (mv)	0.43 ± 0.05	0.3 ± 0.04	<0.05
	LLL (ms)	4.9 ± 0.15	5.1 ± 0.36	
	RLA (uv)	0.44 ± 0.04	0.3 ± 0.06	
	RLL (ms)	4.87 ± 0.15	4.99 ± 0.34	

Table 5 : Somatosensory Evoked Potential at different Time Intervals

SSEP				
Time	Measurement	Groups		
		DP	SP	*P*
T1	LLA (uv)	1.3 ± 0.16	1.3 ± 0.17	>0.05
	LLL (ms)	37.2 ± 1.5	36.9 ± 1.7	
	RLA (uv)	1.3 ± 0.14	1.3 ± 0.14	
	RLL (ms)	37.1 ± 1.6	36.8 ± 1.8	
T2	LLA (uv)	1.28 ± 0.18	1.06 ± 0.17	<0.05
	LLL (ms)	37.5 ± 1.3	38.8 ± 2.03	
	RLA (uv)	1.2 ± 0.08	1.05 ± 0.17	
	RLL (ms)	37.4 ± 1.55	38.2 ± 1.9	
T3	LLA (uv)	1.3 ± 0.14	1.05 ± 0.14	<0.05
	LLL (ms)	37.6 ± 1.5	38.6 ± 1.6	
	RLA (uv)	1.19 ± 0.14	1.02 ± 0.12	
	RLL (ms)	37.6 ± 1.5	38.2 ± 2.04	

There was a decrease in amplitude and an increase in latency of MEP and SSEP at T2 and T3 level of Group SP as compared to Group DP which was significant ($P<0.05$).

There was an approximately 30% decrease in amplitude and an almost 6% increase in latency of group SP in both MEP and SSEP, however when the MAC value of Sevoflurane was decreased to <0.5, it led to a negligible decrease in amplitude and increase in latency.

All the recording of MEP and SSEP at different times T1, T2, and T3 were taken with Propofol going at a maintenance dose of 100 mcg/kg/hr and 100%O_2

No postoperative weakness or deterioration of muscle weakness and sensation was seen in any patient of both the groups.

III. DISCUSSION

Randomised Comparative observational study in lumbar spinal cord tumor showed that addition of Dexmedetomidine to propofol leads to better MEP and SSEP monitoring and has better results than using Inhalational agent like Sevoflurane. Inhalational anesthetic agents have a potent effect on monitoring of MEP and SSEP, leading to decrease by approximately 30% in amplitude and increase in approximately 6% of latency in MEP and SSEP at MAC of 1.5, however on using at MAC <0.5, there is negligible change in amplitude and latency (4,5,6)

All halogenated inhalational agents produce a dose-related increase in latency and reduction in the amplitude of cortically recorded SSEPs [23, 24].

Joseph Zentner et al [24] showed "Electromyographic responses evoked by the stimulation of the lumbar nerve roots were only minimally affected by 1.5 minimal alveolar concentration halothane".
Chong ct et al [25] showed that "Sevoflurane depresses amplitude of MEP in a dose-dependent manner".
Boisseau N et al [26] showed that "Sevoflurane affects SSEP in a dose-dependent manner. There was a decrease in amplitude and an increase in latency of SSEP using Sevoflurane while propofol has minimal effect of SSEP recording".
Malhotra et al [17] reported that "Intraoperative baseline data varied from 70 to 98 % for SSEP and 66 to 100 % for MEP in the absence of neural axis abnormality".

Mahmoud et al [18] reported "two cases of MEP amplitude loss during pediatric spine surgery with dexmedetomidine. One case was of obese child. Propofol and dexmedetomidine doses were calculated on actual body mass".

Yan Li et al [22] reported that "addition of dexmedetomidine to propofol-remifentanil regimen does not exert an adverse effect on MEP and SSEP monitoring in adult patients undergoing thoracic spinal cord tumor resection".

Endrit et al [27] showed that "MEP and SSEP are well maintained with iv Dexmedetomidine during spine surgery".

The multiple advantageous properties of dexmedetomidine make it a potentially useful drug for inclusion in a TIVA regimen in monitored cases [18–21].

Nathan et al [16] showed that "Propofol produces a dose-dependent reduction in the amplitude of MEPs, but has no effect on the latency".

N Boisseau et al [28] showed that "Propofol had minimal effect on SSEP monitoring".

In our study, we also took MEP and SSEP reading after reducing Sevoflurane MAC to <0.5 at T2 and T3 which showed a negligible decrease in amplitude and an increase in latency, but it leads to a lighter plane of anesthesia and an increase in BIS value.
There was also no post-operative neuro deficit in any of our patients of both the groups.

IV. CONCLUSION

Current anesthetic choice of technique is a TIVA regimen using Dexmedetomidine plus propofol for neuromonitoring rather than using an inhalational Agent like Sevoflurane. Sevoflurane leads to significant decrease in amplitude and an increase in latency of MEP and SSEP as compared to Dexmedetomidine.

Acknowledgment:

No funding was taken from anybody.

ABBREVIATION

MEP: Motor Evoked Potential SSEP: Somatosensory Evoked Potential
DP : Dexmedetomidine + Propofol SP : Sevoflurane + Propofol
MAC: Mean Alveolar Concentration N_2O: Nitrous Oxide
tcMEP: Transcranial Motor Evoked Potential C/I: Contraindication
BMI: Body Mass Index SD: Standard Deviation
P: Probability T-Test: Student T-Test
LLA: Left Lower Limb Amplitude LLL: Left Lower Limb Latency
RLA: Right Lower Limb Amplitude RLL: Right Lower Limb Latency
M/F: Male / Female Inj: Injection
NS: Normal Saline

REFERENCES

[1]. Pajewski TN, Arlet V, Phillips LH. Current approach on spinal cord monitoring: the point of view of the neurologist, the anesthesiologist and the spine surgeon. *Eur Spine J*. 2007;16 Suppl 2(Suppl 2):S115-S129. doi:10.1007/s00586-007-0419-6

[2] Burke D, Hicks RG. Surgical monitoring of motor pathways. J Clin Neurophysiol. 1998 May;15(3):194-205. doi: 10.1097/00004691-199805000-00003. PMID: 9681557..

[3]. Tabaraud F, Boulesteix JM, et al. Monitoring of the motor pathway during spinal surgery. Spine.1993;18(5):546–550. doi: 10.1097/00007632-199304000-00005.

[4]. Chen Z. The effects of isoflurane and propofol on intraoperative neurophysiological monitoring during spinal surgery. J Clin Monit Comput. 2004 Aug;18(4):303-8. doi: 10.1007/s10877-005-5097-5. PMID: 15779842.

[5]. Wang AC, Than KD, Etame AB, La Marca F, Park P. Impact of anesthesia on transcranial electric motor evoked potential monitoring during spine surgery: a review of the literature. Neurosurg Focus. 2009 Oct;27(4):E7. doi: 10.3171/2009.8.FOCUS09145. PMID: 19795956.

[6]. Lotto ML, Banoub M, Schubert A. Effects of anesthetic agents and physiologic changes on intraoperative motor evoked potentials. J Neurosurg Anesthesiol. 2004 Jan;16(1):32-42. doi: 10.1097/00008506-200401000-00008. PMID: 14676568.

[7]. Mariappan, Ramamani MD; Ashokkumar, Harinarayanaprabhu MD; Kuppuswamy, Balaji MD Comparing the Effects of Oral Clonidine Premedication With Intraoperative Dexmedetomidine Infusion on Anesthetic Requirement and Recovery From Anesthesia in Patients Undergoing Major Spine Surgery, Journal of Neurosurgical Anesthesiology: July 2014 - Volume 26 - Issue 3 - p 192-197 doi: 10.1097/ANA.0b013e3182a2166f

[8]. Freeman KA, Fullerton DA, Foley LS, Bell MT, Cleveland Jr JC, Weyant MJ, et al. Spinal cord protection in alpha-2 agonist-mediated increase in glial cell-line derived neurotropic factor. J Thorac Cardiovasc Surg. 2015;149(2):578–86.

[9]. Maier C, Steinberg GK, Sun GH, Zhi GT, Maze M. Neuroprotection by the alpha 2-adrenoreceptor agonist dexmedetomidine in a focal model of cerebral ischemia. Anesthesiology. 1993 Aug;79(2):306-12. doi: 10.1097/00000542-199308000-00016. PMID: 8102042.

[10]. Hernández-Palazón J, Izura V, Fuentes-García D, Piqueras-Pérez C, Doménech-Asensi P, Falcón-Araña L. Comparison of the Effects of Propofol and Sevoflurane Combined With Remifentanil on Transcranial Electric Motor-evoked and Somatosensory-evoked Potential Monitoring During Brainstem Surgery. J Neurosurg Anesthesiol. 2015 Oct;27(4):282-8. doi: 10.1097/ANA.0000000000000157. PMID: 25574800.

[11]. Chong CT, Manninen P, Sivanaser V, Subramanyam R, Lu N, Venkatraghavan L. Direct comparison of the effect of desflurane and sevoflurane on intraoperative motor-evoked potentials monitoring. J Neurosurg Anesthesiol. 2014 Oct;26(4):306-12. doi: 10.1097/ANA.0000000000000041. PMID: 24487732.

[12]. U. D. Schmid, M.D., J. Boll, M.D., S. Liechti, M.D., J. Schmid, R.N., C. W. Hess, M.D., Influence of Some Anesthetic Agents on Muscle Responses to Transcranial Magnetic Cortex Stimulation: A Pilot Study in Humans, ***Neurosurgery***, Volume 30, Issue 1, January 1992, Pages 85–92, https://doi.org/10.1227/00006123-199201000-00015

[13]. Pechstein U, Cedzich C, Nadstawek J, Schramm J. Transcranial high-frequency repetitive electrical stimulation for recording myogenic motor evoked potentials with the patient under general anesthesia. Neurosurgery. 1996 Aug;39(2):335-43; discussion 343-4. doi: 10.1097/00006123-199608000-00020. PMID: 8832671.

[14]. Van Dongen EP, ter Beek HT, Schepens MA, Morshuis WJ, de Boer A, Aarts LP, Boezeman EH. Effect of nitrous oxide on myogenic motor potentials evoked by a six pulse train of transcranial electrical stimuli: a possible monitor for aortic surgery. Br J Anaesth. 1999 Mar;82(3):323-8. doi: 10.1093/bja/82.3.323. PMID: 10434809.

[15]. Zentner J, Kiss I, Ebner A. Influence of anesthetics—nitrous oxide in particular—on electromyographic response evoked by transcranial electrical stimulation of the cortex. Neurosurgery 1989; 24: 253–6

[16]. Nathan N, Tabaraud F, Lacroix F, Mouliès D, Viviand X, Lansade A, Terrier G, Feiss P. Influence of propofol concentrations on multipulse transcranial motor evoked potentials. Br J Anaesth. 2003 Oct;91(4):493-7. doi: 10.1093/bja/aeg211. PMID: 14504148.

[17] Malhotra NR, Shaffrey CI. Intraoperative electrophysiological monitoring in spine surgery. Spine (Phila Pa 1976). 2010 Dec 1;35(25):2167-79. doi:10.1097/BRS.0b013e3181f6f0d0. PMID: 21102290.

[18]. Mahmoud M, Sadhasivam S, Salisbury S, Nick TG, Schnell B, Sestokas AK, Wiggins C, Samuels P, Kabalin T, McAuliffe J. Susceptibility of transcranial electric motor-evoked potentials to varying targeted blood levels of dexmedetomidine during spine surgery. Anesthesiology. 2010 Jun;112(6):1364-73. doi: 10.1097/ALN.0b013e3181d74f55. PMID: 20460997.

[19]. Anschel DJ, Aherne A, Soto RG, Carrion W, Hoegerl C, Nori P, Seidman PA. Successful intraoperative spinal cord monitoring during scoliosis surgery using a total intravenous anesthetic regimen including dexmedetomidine. J Clin Neurophysiol. 2008 Feb;25(1):56-61. doi: 10.1097/WNP.0b013e318163cca6. PMID: 18303561.

[20]. Tobias JD, Goble TJ, Bates G, Anderson JT, Hoernschemeyer DG. Effects of dexmedetomidine on intraoperative motor and somatosensory evoked potential monitoring during spinal surgery in adolescents. Paediatr Anaesth. 2008 Nov;18(11):1082-8. doi: 10.1111/j.1460-9592.2008.02733.x. PMID: 18717802.

[21]. Rozet I, Metzner J, Brown M, Treggiari MM, Slimp JC, Kinney G et al. Dexmedetomidine does not affect evoked potentials during spine surgery. Anesthesia and analgesia. 2015 Aug 25;121(2):492-501. https://doi.org/10.1213/ANE.0000000000000840

[22]. Li Y, Meng L, Peng Y, et al. Effects of Dexmedetomidine on motor- and somatosensory-evoked potentials in patients with thoracic spinal cord tumor: a randomized controlled trial. *BMC Anesthesiol*. 2016;16(1):51. Published 2016 Aug 2. doi:10.1186/s12871-016-0217-y

[23]. Kalkman CJ, Drummond JC, Ribberink AA. Low concentrations of isoflurane abolish motor evoked responses to transcranial electrical stimulation during nitrous oxide/opioid anesthesia in humans. Anesth Analg. 1991 Oct;73(4):410-5. doi: 10.1213/00000539-199110000-00008. PMID: 1832825.
[24]. Zentner J, Albrecht T, et al. Influence of halothane, enflurane, and isoflurane on motor evoked potentials. Neurosurgery. 1992;31(2):298–305. doi: 10.1097/00006123-199208000-00015
[25]. Direct comparison of the effect of desflurane and sevoflurane on intraoperative motor-evoked potentials monitoring. Chong CT[1], Manninen P, Sivanaser V, Subramanyam R, Lu N, Venkatraghavan L. J Neurosurg Anesthesiol. 2014 Oct;26(4):306-12. doi: 10.1097/ANA.0000000000000041.
[26]. Comparison of the effects of sevoflurane and propofol on cortical somatosensory evoked potentials. Boisseau N[1], Madany M, Staccini P, Armando G, Martin F, Grimaud, Raucoules-Aimé M. Br J Anaesth. 2002 Jun;88(6):785-9.
[27]. Bala E, Sessler DI, Nair DR, McLain R, Dalton JE, Farag E. Motor and somatosensory evoked potentials are well maintained in patients given dexmedetomidine during spine surgery. Anesthesiology. 2008 Sep;109(3):417-25. doi: 10.1097/ALN.0b013e318182a467. PMID: 18719439.
[28]. Boisseau N, Madany M, Staccini P, et al. Comparison of the effects of sevoflurane and propofol on cortical somatosensory evoked potentials. *Br J Anaesth*. 2002;88(6):785-789. doi:10.1093/bja/88.6.785

Corresponding Author: Dr. Manisha S Kapdi
[2](Associate Professor, SVP Hospital, Ahmedabad)