DOI: 10.7860/JCDR/2021/49237.15242

Original Article

Anaesthesia Section

Epidural Ropivacaine and Dexmedetomidine with that of Epidural Ropivacaine and Fentanyl for Postoperative Analgesia in Lumbar Spine Surgeries- A Randomised Double-Blinded Study

G PRASHANTH[1], SULOCHANA DASH[2], SUDEEP MOHAPATRA[3], NUPUR MODA[4]

ABSTRACT

Introduction: Epidural with opioids as adjuvants are the most common agents of choice for postoperative analgesia in spine surgeries which promote early ambulation, increased patient satisfaction and improved outcome. Recently, epidural administration of α_2 agonists in combination with local anaesthetics in low doses offers new dimensions in the management of postoperative pain.

Aim: To compare the analgesic efficacy, sedation score and haemodynamic stability of Epidural Ropivacaine and Fentanyl (RF) with that of Ropivacaine and Dexmedetomidine (RD) in the postoperative period in lumbar spine surgeries.

Materials and Methods: This was a randomised, double-blinded study conducted on 120 patients at IMS and SUM Hospital, Bhubaneswar, Khordha, India. Haemodynamic parameters, Visual Analogue Score (VAS), sedation score, time to 1st dose of rescue analgesics requirement and complications were observed. The study consisted of group RF that received ropivacaine and fentanyl and group RD that received ropivacaine and dexmedetomidine, with 60 patients in each group. Continuous variables were analysed with the unpaired t-test and categorical variables were analysed with Chi-square Test and Fisher-Exact test. Statistical significance was taken as p <0.05

Results: The mean age of participants in group RD was 39.73±7.192 years and in group RF was 40.67±7.434 years (p-value 0.872). Heart rate was in lower range in RD group throughout the study and was statistically significant with a p-value <0.05. VAS score was lower, sedation score was higher and time to 1st dose of rescue analgesia were longer in RD group compared to group RF (p<0.005). Complications like hypotension (33.3%), bradycardia (20%) were more common in group RD while nausea, vomiting (16.67%) and pruritis (10%) were noted in group RF.

Conclusion: Dexmedetomidine seems to be a better neuraxial adjuvant with good postoperative analgesic efficacy, better patient comfort and hemodynamic stability compared with that of fentanyl.

Keywords: Pain, Rescue analgesic requirement, Visual analog scale

INTRODUCTION

Spine surgeries are usually associated with intense postoperative pain due to large surgical incision, which delays recovery and prevents early ambulation. So, adequate post operative analgesia is required for adequate pain control and early ambulation. Epidural anaesthesia is very helpful for controlling such kind of pain and by far considered the gold standard. Use of local anaesthetic with adjuvants like opioids and alpha-2 agonists through an epidural catheter placed intraoperatively under direct vision at the end of the procedure is the method of choice for managing postoperative pain in these cases [1].

Ropivacaine, a newer amide local anaesthetic, is a better choice due to its longer duration of action with minimal cardiovascular, central nervous system adverse effects as well as the lesser tendency of the motor blockade [2]. Although opioids like morphine, fentanyl are commonly used as adjuvants for better postoperative analgesia, still the occurrence of pruritis, urinary retention, nausea, vomiting and respiratory depression is quite common [3]. So there is always a need for a better adjuvant. Among the available adjuvants, the newer adjuvant Dexmedetomidine is considered a better choice. dexmedetomidine, an imidazoline derivative, 1600 times more potent for α2 receptor. It acts on both pre and postsynaptic sympathetic nerve terminals and the central nervous system, thereby diminishing sympathetic outflow and norepinephrine release causing sedation, anxiolysis, and good postoperative analgesia [4]. There are few studies to show the efficacy of epidural opioid to control post operative pain after lumbar spine surgeries [5,6]. Epidural opioid administration provides extended analgesia and decreases incidences of respiratory and thromboembolic events, making it a promising route of drug delivery for post operative analgesia. These epidural opioids as adjuvant have side-effects such as nausea, vomiting, and pruritis but very few studies are there to show efficacy of dexmedetomidine. The higher affinity and selectivity of dexmedetomidine aid in decreasing the dosages as well as adverse effects of local anaesthetics and opioids when used simultaneously with dexmedetomidine. Dexmedetomidine presumably acts on the nociceptive cascade and prevents the sensitisation of nociceptors present in the dorsal horn [4].

So, the present study was performed to evaluate the analgesic efficacy, haemodynamic changes and adverse effects of epidural ropivacaine and dexmedetomidine with that of ropivacaine and fentanyl in patients undergoing elective lumbar spine surgeries (decompression and fixation for Prolapsed intervertebral disc). The primary outcomes were-pain score, sedation score and haemodynamic changes at 30 minutes, 1, 6, 12, 24, 36 and 48 hours post operatively; the secondary outcomes were the time of request of 1st analgesic dose and total number of analgesic top-up doses in both groups.The tertiary outcomes were- adverse effects like Postoperative Nausea and Vomiting (PONV), shivering, pruritis, hypotension, bradycardia, respiratory depression and dry mouth at 30 minutes, 1, 6, 12, 24, 36 and 48 hours postoperatively.

MATERIALS AND METHODS

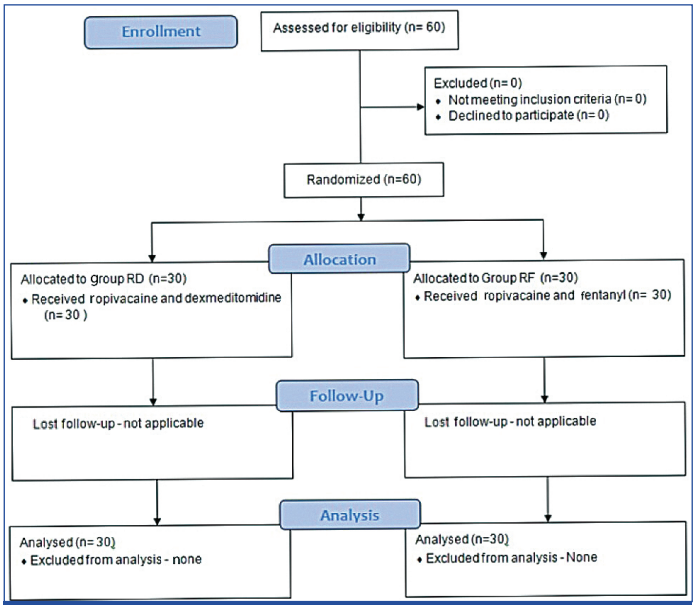
This study was an open-labelled, randomised, double-blinded study conducted in IMS and SUM Hospital, from June 2019 to December 2020. The institutional ethical committee had approved the study (IMS.SHISOA/180268).

Inclusion criteria: Sixty patients of the age group of 30-60 years, of either sex belonging to ASA I andII, posted for elective lumbar spine surgeries were included in this study.

Exclusion criteria: Patients not willing to participate, allergic to local anaesthetics or study drugs, patients having cardiovascular, renal, liver and coagulation disorders were excluded from this study.

Sample size calculation: The sample size was calculated based on a study by Saravana babu MS et al., [7]. The confidence level was estimated at 95%, the Z value of 1.96 and the margin of error estimated at ±12.

The patients were assigned randomly into two equal groups (Group-RF and Group RD) of 30 each by using computer-generated random numbers [Table/Fig-1].



[Table/Fig-1]: Consort flow diagram.

Preanesthetic check-up and all routine haematological investigations (complete blood count, serum creatinine) and Electrocardiogram (ECG) were done. Patients were kept nil by mouth for six hours before surgery.

A 10 cm Visual Analogue Scale (0, no pain and 10, worst pain imaginable) was also explained during the preoperative visit.The patients were then shifted to the operating room, and general anaesthesia was conducted using the standard operating protocols and all standard monitoring where done. Surgery was done in the prone position, after completion of surgical procedure and before the closure of wound; 18-gauge epidural catheter was placed under direct vision in epidural spacepreferably L2-3 and L3-4 through a separate skin puncture by 16-gauge epidural needle at a distance of 2 cm away from the surgical incision. A 5 cm of the catheter was kept inside epidural space and anchoredon the patients back using adhesive tape. After closing and dressing the surgical wound, patients were made supine and extubated after adequate reversal. A test dose of 3 mL lignocaine with adrenaline (1:200,000) was injected into all patients to confirm epidural catheter position, patients were shifted to the recovery room, monitored for half hour. The pain was assessed by VAS when VAS>3 study was started.

Epidural analgesia was activated as follows:

Group RD (n=30); ropivacaine 0.2% + dexmeditomidine 1 mcg/kg, loading dose of 12 mL followed by maintenance dose of 5 ml/hr.

Group RF (n=30); ropivacaine 0.2% + fentanyl 1mcg/kg, loading dose of 12 mL followed by maintenance dose of 5 ml/hr

After administering the test drugs, the following parameters were recorded: pain by visual analogue scale, sedation by Ramsay sedation score, heart rate, Mean Arterial Pressure (MAP), Oxygen saturation, Time to 1st dose of rescue analgesic and the total number of rescue analgesic doses and adverse effects were also noted at 0.5, 1, 6, 12, 24, 36 and 48 hours. Hypotension was termed as fall in MAP more than 20% from baseline, and it was managed by intravenous fluids and injection ephedrine 3-6 mg iv bolus, bradycardia (HR< 50 beats/min) was treated with injection atropine 0.01 mg/kg IV bolus and post operative nausea vomiting was managed by injection ondansetron 4 mg IV. Respiratory depression was defined as Respiratory Rate (RR)<12, decrease in SpO_2 <95% managed with oxygen supplementation at the rate 6L/min by mask.

STATISTICAL ANALYSIS

Continuous variables were analysed with the unpaired t-test and categorical variables were analysed with Chi-square Test and Fisher-Exact test. Statistical significance was taken as p-value ≤0.05 and data were analysed using Statistical Package For The Social Sciences (SPSS) software (version 20.0) and Microsoft Excel 2016.

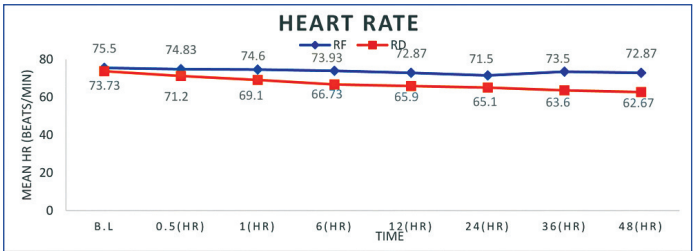
RESULTS

The mean age of participants in group RD was 39.73±7.192 years and in group RF was 40.67±7.434 years (p-value 0.872). Male to female ratio was 1.14:1 in group RD and 1:1 in group RF. The mean weight was 66.93±8.094 in group RD and 69.00±8.57 in group RF. (p-value 1.000). From baseline to 48 hours, the mean heart rate of the patients in group RF ranged from 71.5±5.250/min to 75.5±4.032/minute and in the group RD, it ranged from 62.7±1.473 to 73.73±4.290/minutes. HR was in lower range in RD group throughout the study and was statistically significant with a p-value <0.05. Mean MAP was within 71.46±4.431 to 93.27±5.343/mmHg in the group RF, and in the group RD, it was 69.27±3.561 to 92.87±5.28/mm hg. Slight reduction in MAP was noted in RD group (p- value <0.05) at 1st (p=0.045), 6th (p=0.019) hour, 24th (p=0.014) and 48th (p=0.038) hour. There was no statistically significant difference in mean SPO_2 levels in both groups except at 6th hour (p-value 0.035) [Table/Fig-2-4].

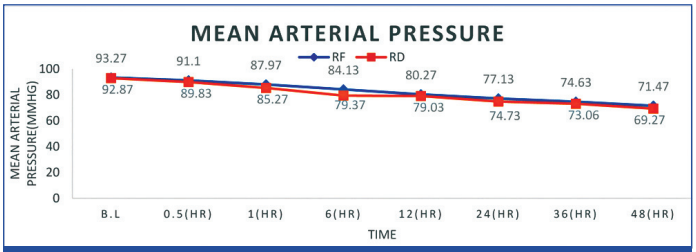
Time	Group	Heart Rate		Mean Arterial Pressure		Oxygen Saturation	
		Mean ±SD	p-value	Mean±SD	p-value	Mean±SD	p-value
Base Line	RF	75.5±4.03	0.10	93.27±5.34	0.77	98.4±0.56	0.83
	RD	73.73±4.29		92.87±5.28		98.43±0.67	
30 min	RF	74.83±4.54	<0.05	91.1±5.14	0.34	97.96±0.71	0.41
	RD	71.2±4.49		89.83±5.21		97.83±0.53	
1 hr	RF	74.6±5.91	<0.05	87.97±5.15	0.045	98±0.52	0.035
	RD	69.1±4.91		85.27±5.07		97.83±0.91	
6 hr	RF	73.93±5.94	<0.05	84.13±4.89	0.019	98.46±0.57	0.03
	RD	66.73±5.50		79.37±9.49		97.96±1.12	
12 hr	RF	72.87±6.37	<0.05	80.27±5.80	0.35	98.46±0.68	0.11
	RD	65.9±4.52		79.03±4.43		97.83±2.06	
24 hr	RF	71.5±5.25	<0.05	77.13±6.19	0.014	98.43±0.56	0.13
	RD	65.1±2.24		74.73±6.30		98.16±0.79	
36 hr	RF	73.5±4.90	<0.05	74.63±4.51	0.14	98.36±0.49	0.53
	RD	63.6±2.01		73.06±3.75		98.26±0.73	
48 hr	RF	72.87±4.23	<0.05	71.47±4.43	0.035	98.6±0.56	0.32
	RD	62.67±1.47		69.27±3.56		98.33±1.37	

[Table/Fig-2]: Heart rate, mean arterial pressure and oxygen saturation of both the groups (unpaired t -test)

Most of the patients had sedation scores in the range of one to two in group RF and in the group RD, scores ranged from two to three. Throughout the study, sedation scores were higher in the group RD and were statistically significant with a p-value of <0.05 at 1,6,12,

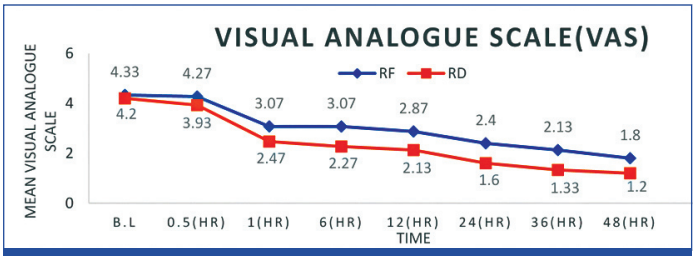


[Table/Fig-3]: Changes in heart rate across different time period.



[Table/Fig-4]: Changes in Mean arterial pressure across different time period.

24 and 36 hours. Most patients had a VAS score range of 2-4 in group RF when compared to group RD, where the score was 0-2 [Table/Fig-5-6].



[Table/Fig-5]: Changes in Visual analogue scale (VAS) across different time period.

Time	Group	Ramsay sedation score		Visual analogue score	
		Mean±SD	p-value	Mean±SD	p-value
Baseline	RF	1.06±0.25	0.40	4.33±0.75	0.13
	RD	1.13±0.34		4.2±0.61	
30 minutes	RF	1.2±0.40	0.38	4.27±0.69	0.64
	RD	1.3±0.46		3.93±0.82	
1 hours	RF	1.33±0.47	<0.05	3.07±1.36	<0.05
	RD	1.96±0.76		2.47±0.86	
6 hours	RF	2.0±0.58	0.02	3.07±1.36	<0.05
	RD	2.4±0.67		2.27± 0.69	
12 hours	RF	2.13 ±0.57	<0.05	2.87±1.13	<0.05
	RD	2.96±0.55		2.13±0.50	
24 hours	RF	2.2±0.48	<0.05	2.4±1.10	0.52
	RD	3.03±0.55		1.6±0.96	
36 hours	RF	1.5±0.50	<0.05	2.13±1.04	0.01
	RD	2.03±0.55		1.33±0.95	
48 hours	RF	1.2±0.40	0.09	1.8±0.17	0.01
	RD	1.4±0.49		1.2±0.18	

[Table/Fig-6]: Ramsay sedation score and visual analogue scale score of both the groups (unpaired t -test)

The mean time of 1st dose of rescue analgesia after surgery was 6.71±0.53 hours in Group RF and 8.75±0.44 hours in group RD, with a p-value of 0.05.Mean rescue analgesic doses were 3.5±0.548 in Group RF and 2.5±0.577 in group RD. The requirement of rescue analgesic doses was less in group RD (p-value 0.024) [Table/Fig-7].

Complications like hypotension, bradycardia and dry mouth were higher in Group RD, while complications like postoperative nausea, vomiting, pruritis, respiratory depression and shivering were seen in Group RF [Table/Fig-8].

Group	Mean time of 1st Dose of Rescue Analgesia requirement after surgery(hr)		Mean rescue analgesic doses (mg)	
	Mean±SD	p-value	Mean±SD	p-value
RF	6.71±0.53	0.05	3.5 ±0.54	0.02
RD	8.75±0.44		2.5 ±0.57	

[Table/Fig-7]: Requirement of rescue analgesic and top up dose of both the groups (unpaired t-test)

Complications	Group RD, N(%)	Group RF, N(%)	p-value
Postoperative nausea and vomiting	2 (6.67%)	5 (16.67%)	0.42
Hypotension	10 (33.33%)	2 (6.67%)	<0.05
Bradycardia	6 (20%)	0	-
Respiratory depression	0	2 (6.67%)	-
Pruritis	1 (3.33%)	3 (10%)	0.60
Shivering	0	2 (6.67%)	-
Dry mouth	5 (16.67%)	0	-

[Table/Fig-8]: Complications in both the Groups (Chi-square Test and Fisher-Exact test).

DISCUSSION

Patients undergoing spine surgeries complain of severe pain in the postoperative period, which may increase morbidity, the incidence of complications and prolong postoperative rehabilitation. Postoperative pain therapy mainly consists of the administration of oral or intravenous opioids in combination with non-steroidal anti-inflammatory drugs, but it often results in insufficient pain control and side effects such as respiratory depression, nausea, and vomiting are quite common [8].

Epidural anaesthesia and analgesia are superior to intravenous analgesia with respect to the quality of pain relief, incidence of side-effects, pulmonary, cardiac, and gastrointestinal complications [7]. Toledano RD and Van de Velde M, showed in an observational study that epidural catheters placed intraoperatively by the surgeon followed by infusion of local anaesthetics with or without opioids could provide good analgesia after posterior spinal fusion [9].

In this study, though the HR and MAP were in the lower range in the dexmedetomidine group, haemodynamic stability was maintained in both dexmedetomidine and fentanyl groups. Similar findings were reported by Bajwa SJ et al., that studied ropivacaine with dexmedetomidine vs fentanyl for epidural analgesia in lower limb orthopaedic surgeries [10]. The study by Shah PJ et al., revealed sedation scores were higher in the dexmedetomidine group with a range of 2 to 3 in most of the patients as compared to the fentanyl group where it was 1-2, and this difference is statistically significant [11]. A study by Paul A et al., on dexmedetomidine vs fentanyl as an adjuvant to epidural Bupivacaine in lower limb surgeries too showed similar results like the index study [12]. Sedation scores in a study by Alansary AM et al., showed a similar result; dexmedetomidine had better sedation score when compared with fentanyl given as epidural adjuvant [13].

Throughout the study, VAS scores were lower in RD group. The results are similar to the study by Meitie AJ et al., who concluded that VAS score was less in ropivacaine plus dexmedetomidine (5.60±1.118) compared to ropivacaine group (6.08±0.997) [14]. As per the index study, dexmedetomidine group needed rescue analgesia after a longer period of time compared to fentanyl group. Mean rescue analgesic doses were 3.5±0.548 in RF group and 2.5±0.577 in RD group. These results are similar to the study by Kiran S et al., which showed that dexmedetomidine decreased the total number of rescue analgesic doses [15].

Complications like bradycardia, hypotension and dry mouth were commonly seen in the dexmedetomidine group, but postoperative nausea, vomiting, pruritis, shivering was observed commonly in the fentanyl group.The present study results are similar to those of Kiran S et al., which concluded that postoperative nausea vomiting, pruritis and shivering were common with fentanyl while hypotension, bradycardia and dry mouth with dexmedetomidine [15].

Limitation(s)

Equipotent dose of fentanyl and dexmedetomidine were not defined, and as most patients were immobile, so exact weight could not be measured, and approximate weight was considered using nomograms.

CONCLUSION(S)

Dexmedetomidine seems to be a better neuraxial adjuvant compared to fentanyl as it has good analgesic efficacy shown with lower VAS Scores. Although it has a slightly higher sedation score, it makes the patients calm, comfortable and at the same time, the patient is arousable and responds to commands. Also, the time of requirement of 1st dose of rescue analgesia was delayed, and patients needed fewer analgesic doses when epidural dexmedetomidine is used. Although complications like hypotension and bradycardia are common but are easily manageable, and haemodynamic stability is well maintained.

REFERENCES

[1] Gottschalk A, Freitag M, Tank S, Burmeister MA, Kreil S, Kothe R, et al. Quality of postoperative pain using an intraoperatively placed epidural catheter after major lumbar spinal surgery. Anesthesiology. 2004;101(1):175-80.
[2] Mannan SA, Rabiaarifa, Hamid S. Comparison of epidural ropivacaine plus dexmeditomidine with epidural ropivacaine plus fentanyl in total hip replacement surgeries. International Journal of Scientific Research. 2017;6(7).
[3] Swain A, Nag DS, Sahu S, Samaddar DP. Adjuvants to local anesthetics: Current understanding and future trends. World J Clin Cases. 2017;5(8):307-23.
[4] Gupta K, Ratogi B, Gupta PK, Jain M, Gupta S, Mangala D. Epidural 0.5% Levobupivacaine with Dexmedetomidine versus Fentanyl for vaginal hysterectomy: a prospective study. Indian J Pain. 2014;28:149-54.
[5] Schmidek HH, Cutler SG. Epidural morphine for control of pain after spinal surgery: a preliminary report. Neurosurgery. 1983;13(1):37-39.
[6] Tobias JD. A review of intrathecal and epidural analgesia after spinal surgery in children. Anesth Analg. 2004;98(4):956-65.
[7] Saravana Babu M, Verma AK, Agarwal A, Tyagi CM, Upadhyay M, Tripathi S. A comparative study in the postoperative spine surgeries: Epidural ropivacaine with dexmedetomidine and ropivacaine with clonidine for postoperative analgesia. Indian J Anaesth. 2013;57(4):371-76.
[8] Bajwa SJ, Haldar R. Pain management following spinal surgeries: An appraisal of the available options. J Craniovertebr Junction Spine. 2015;6(3):105-10.
[9] Toledano RD, Van de Velde M. Epidural Anesthesia and Analgesia. https://www.nysora.com (accessed 3 March 2021).
[10] Sice PJ, Chan D, MacIntyre PA. Epidural analgesia after spinal surgery via intervertebral foramen. Br J Anaesth. 2005;94(3):378-80.
[11] Shah PJ, Naik R, Bhagat C, Talreja K. Dexmedetomidine v/s Fentanyl with 0.75% Ropivacaine for epidural anaesthesia in lower abdominal surgeries. J Anaes and Inten Care Med. 2017;3(3):55561.
[12] Paul A, Nathroy A, Paul T. A comparative study of dexmeditomidine and Fentanyl as an adjuvant to epidural bupivacaine in lower limb surgeries. J Med Sci. 2017;37:221-26.
[13] Alansary AM, Elbeialy MAK. Dexmedetomidine versus Fentanyl added to bupivacaine for epidural analgesia in combination with general anesthesia for elective lumbar disc operations: A prospective, randomised double-blinded study. Saudi J Anaesth. 2019;13(2):119-25.
[14] Meitei AJ, Ningombam T, Singh TH, Rajkumar G, Devi NA, Singh YA. A comparative study of ropivacaine versus ropivacaine plus dexmedetomidine under epidural anesthesia in lower limb surgeries. Journal of Medical Society. 2019;33(1):20-27.
[15] Kiran S, Jinjil K, Tandon U, Kar S. Evaluation of dexmedetomidine and fentanyl as additives to ropivacaine for epidural anesthesia and postoperative analgesia. J Anaesthesiol Clin Pharmacol. 2018;34(1):41-45.

PARTICULARS OF CONTRIBUTORS:
1. Senior Resident, Department of Anesthesiology, IMS and SUM Hospital, SOA deemed to be University, Bhubaneswar, Khordha, India.
2. Professor, Department of Anesthesiology, IMS and SUM Hospital, SOA deemed to be University, Bhubaneswar, Khordha, India.
3. Professor, Department of Anesthesiology, IMS and SUM Hospital, SOA deemed to be University, Bhubaneswar, Khordha, India.
4. Assistant Professor, Department of Anesthesiology, IMS and SUM Hospital, SOA deemed to be Universit Bhubaneswar, Khordha, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Nupur Moda,
Assistant Professor, Department of Anesthesiology, IMS and SUM Hospital,
Kalinga Nagar, Ghatikia, Bhubaneswar, Khordha, India.
E-mail: drnups@yahoo.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Mar 03, 2021
- Manual Googling: Jun 02, 2021
- iThenticate Software: Jul 08, 2021 (14%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Mar 02, 2021**
Date of Peer Review: **Apr 02, 2021**
Date of Acceptance: **Jun 18, 2021**
Date of Publishing: **Aug 01, 2021**