

**Original Article**

Comparison of Hemodynamic Response to IV Dexmedetomidine and IV Clonidine in Spine Surgery under General Anaesthesia

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Email: dr.rohini88@gmail.com, Mobile no.9823017640**ABSTRACT**

AIMS: Alpha 2 agonist are popularly used as adjunct in general anaesthesia. A study was carried out to investigate the ability of intravenous Dexmedetomidine vs Clonidine to maintain hemodynamic response in spine surgery.

METHODS: 60 patients scheduled for spine surgery were randomized in two groups of 30 each. Group D-received 0.5µg/kg Dexmedetomidine IV diluted in 10ml of normal saline given slowly over 10 min. Group C-received 0.5µg/kg Clonidine IV diluted in 10 ml of normal saline given slowly over 10 min.

Hemodynamic parameter were recorded after 10 min of giving study drug. Observations of parameters were maintained at 2,5,10 min and carried out till 110 min of duration.

RESULTS: The demographic profile was comparable. The pressor response to laryngoscopy, intubation, surgery and extubation were effectively decreased with dexmedetomidine and was highly significant on comparison with clonidine ($P < 0.0001$).

CONCLUSION: Dexmedetomidine is an excellent drug to maintain hemodynamic response to intubation as compared to clonidine in spine surgery, and better in achieving adequate analgesia and anaesthesia perioperatively.

KEYWORDS: Spine surgery, Dexmedetomidine, Clonidine, General anaesthesia.

Introduction

The patients undergoing spine surgery like micro discectomy, reconstructive surgery, Decompression surgery, vertebral fracture fixation, debridement fixation etc. may present

with intraoperative blood loss, major fluid shift or acute postoperative pain. Hence it is mandatory for an anaesthetist to opt for a technique which allows hemodynamic stability throughout the procedure¹

Among both alpha 2 agonists viz. Clonidine and Dexmedetomidine, later is highly specific and selective. Its advantage in anaesthesia setting includes sedation, analgesia, anxiolysis and improved hemodynamic stability by activation of alpha 2 receptor located in postsynaptic terminal in central nervous system, which causes augmentation of vagal activity^{2,3}

Accordingly a study was designed to compare the hemodynamic response of IV Dexmedetomidine and IV Clonidine in spine surgery performed under general anaesthesia.

Materials and Methods

After approval from hospital ethical committee. a prospective randomized clinical comparative study, was undertaken in 60 patient of either sex, between 18-55yrs of age of ASA Grade I&II undergoing spine surgery under general anaesthesia. Patients not fulfilling the eligibility criteria, lack of patient's consent and with other co-morbidities like asthma, IHD, Renal dysfunction or allergy to study drug were excluded from the study. Patients were divided in two groups by using simple random sampling by lottery method. After thorough pre anaesthetic evaluation, baseline blood investigations like Hb, CBC, LFT, PT, INR, RFT, Sr. Electrolytes with, X-ray Chest, ECG was performed..

Patients were shifted to operation theatre and after starting I.V fluids, baseline parameters like Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic blood pressure (DBP), Mean arterial pressure (MAP), Oxygen saturation (SPO2), Respiratory rate (RR). were recorded by non invasive monitor. **Group D** - Inj Dexmedetomidine 0.5µg/kg IV diluted in 10 ml normal saline was administered slowly 10 minute before induction.

Group C- Inj Clonidine 0.5µg/kg IV diluted in 10 ml normal saline was administered slowly 10 min before induction.

Preloading was done with Ringer Lactate 10ml/kg.

After 5 min of pre oxygenation, Inj Midazolam (0.03-0.05mg/kg) + Inj Pentazocine 0.5mg/kg + inj Glycopyrrolate 0.2mg + inj Ondansetron 4mg IV. was given as pre medication.

Patients were induced with Inj Propofol 2 mg/kg IV. and Inj Succinylcholine 2mg/kg IV was given for intubation.

Anaesthesia was maintained with oxygen and nitrous oxide (50:50), isoflurane and Inj Vecuronium 0.08mg/kg intermittently. Tidal volume of 6-8ml/kg and respiratory rate of 12-18bpm. was maintained intraoperatively. Surgery was performed in prone position. Hemodynamic responses were compared in both groups by measuring HR, SBP, DBP, MAP, RR, SPO2 at following interval.

Before giving the test drug (Basal) value - **T0**

T1- after completion of drug

T2 – at induction

T3 – at intubation

After intubation at 2,5,10 min interval, monitoring was carried out till 110 min. Inj. Paracetamol 10mg/kg IV was given for postoperative analgesia.

Reversal was done with Inj. Neostigmine 0.05mg/kg IV and Inj. Glycopyrrolate 0.08mg/kg IV and patients were extubated when reversal was adequate.

Result

Total 60 patients were recruited for the study. 30 patients were allocated in each group. Patient's characteristics as well as duration of anaesthesia and surgery were comparable in both the groups.

Table 1: Demographic Data

Data	Grp D	Grp C	P value
Age	38.63± 7.87	36.47 ± 7.52	0.281 NS
Weight	57.53± 3.89	56.67± 3.81	0.386NS
ASA Gr I/II	26/4	25/5	
Average Duration of Anaesthesia	110min	110min	

Table 2: Comparison of Mean Heart Rate in Group D & Group C

HR	Group D Mean \pm SD	Group C Mean \pm SD	t-value	P-value
Baseline	92.30 \pm 5.43	90.66 \pm 7.26	0.943	P=0.349 NS
After Study Drug	93.63 \pm 5.68	93.63 \pm 6.69	3.45	P=0.001 S
At Induction	84.83 \pm 5.66	95.26 \pm 4.43	7.94	P<0.0001 S
At Intubation	81.60 \pm 4.95	94.20 \pm 4.49	10.37	P<0.0001 S
2 Min After Intubation	78.10 \pm 5.65	92.50 \pm 4.81	10.52	P<0.0001 S
5 Min After Intubation	76.20 \pm 5.80	93.26 \pm 5.48	11.69	P<0.0001 S
10 Min After Intubation	76.56 \pm 5.92	92.06 \pm 5.56	10.44	P<0.0001 S
25 Min After Intubation	73.33 \pm 5.71	91.56 \pm 5.95	12.04	P<0.0001 S
40 Min After Intubation	71.93 \pm 4.79	90.73 \pm 6.25	13.06	P<0.0001 S
65 Min After Intubation	69.60 \pm 5.39	90.53 \pm 6.25	17.01	P<0.0001 S
80 Min After Intubation	67.56 \pm 4.81	90.86 \pm 5.31	17.86	P<0.0001 S
95 Min After Intubation	66.46 \pm 4.62	91.10 \pm 6.42	17.04	P<0.0001 S
110 Min After Intubation	64.96 \pm 4.38	90.40 \pm 6.66	17.46	P<0.0001 S

This table shows fall in mean HR more in group D than that of group C which is statistically highly significant (P<0.0001).

Table 3: Comparison of Mean MAP in Group D & Group C:

MAP	Group D Mean \pm SD	Group C Mean \pm SD	t-value	P-value
Baseline	90.23 \pm 4.36	89.36 \pm 4.60	0.794	P=0.475 NS
After Study Drug	85.27 \pm 2.71	92.20 \pm 4.54	7.17	P<0.0001 S
At Induction	82.13 \pm 4.57	90.70 \pm 4.97	6.94	P<0.0001 S
At Intubation	79.33 \pm 5.67	91.83 \pm 4.02	9.83	P<0.0001 S
2 Min After Intubation	76.30 \pm 4.15	90.84 \pm 4.06	13.70	P<0.0001 S
5 Min After Intubation	73.93 \pm 3.90	89.33 \pm 3.08	16.94	P<0.0001 S
10 Min After Intubation	71.73 \pm 2.82	89.96 \pm 4.78	17.78	P<0.0001 S
25 Min After Intubation	70.80 \pm 2.60	92.10 \pm 3.76	25.49	P<0.0001 S
40 Min After Intubation	69.47 \pm 3.38	91.56 \pm 4.72	20.83	P<0.0001 S
65 Min After Intubation	67.80 \pm 6.59	89.53 \pm 3.72	15.70	P<0.0001 S
80 Min After Intubation	67.33 \pm 3.09	91.40 \pm 3.96	26.20	P<0.0001 S
95 Min After Intubation	67.32 \pm 3.31	90.43 \pm 4.60	23.09	P<0.0001 S
110 Min After Intubation	66.93 \pm 3.03	88.43 \pm 3.31	21.23	P<0.0001 S

This table shows fall in mean DBP more in Group D than that in Group C which is statistically highly significant (P<0.0001).

No significant change in mean RR was found in either group (P=0.326)..So also no significant changes in SpO₂ were found in both group D and C (P=0.348), as saturation was maintained to 100% throughout the procedure.

Discussion

Perioperative stress associated with surgery and anaesthesia evokes an endocrine response resulting into stimulation of sympathetic nervous system. The increased circulating plasma adrenaline and nor adrenaline concentration consequently increases arterial pressure, heart rate and O₂ consumption.⁴

Currently used α_2 agonists viz. Clonidine and Dexmedetomidine fulfill the above criteria well. Both clonidine and dexmedetomidine have action

on α_1 and α_2 receptors but dexmedetomidine is highly specific and selective α_2 adrenoceptor with α_2 : α_1 binding selectivity ratio of 1620: 1 compared to 220:1 for clonidine.⁵ Dexmedetomidine, a central α_2 adrenergic agonist is increasingly gaining popularity in anaesthesia as it has been successfully used as sedative, anaesthetic agent and analgesic agent in number of surgical, endoscopic and radiological procedures with minimum adverse effects as it acts through α_2 receptor in locus ceruleus and its analgesic property is due to the receptor stimulation of spinal dorsal horn.⁶

In this study, all patients were compared for age weight and sex and were found to be nonsignificant.

Demographic Data

All patients were comparable with respect to demographic parameters like age, weight, sex. In group D there were 16 males and 14 females and in group C there were 13 males and 17 females. In group D: Mean age was 38.63 ± 7.87 while in group C: it was 36.47 ± 7.52 . Statistical comparison with unpaired "t" test was non significant. ($p=0.281$).

Similarly mean weight in group D was 57.53 ± 3.89 and mean weight in group C was 56.67 ± 3.81 . It was statistically nonsignificant ($p=0.386$).

Heart Rate

Sameer Arora et al⁵ and Shirsendu et al² have demonstrated transient increase in HR within 3-5 minutes of dexmedetomidine infusion followed by decrease in HR and is probably due to vasoconstriction effect of dexmedetomidine appearing earlier than central sympathetic action. We monitored all the patients for 110 min. from the time of infusion of study drug. In our study mean HR was 95.26 ± 4.43 in group C and 84.83 ± 5.6 in group D after induction, whereas at it was 81.60 ± 4.95 in group D and 94.20 ± 4.49 in group C at intubation. ., At the end of 110 minutes mean HR was 64.96 ± 4.38 In Group D and 90.40 ± 6.66 , in group C. Statistically significant stability in heart rate was observed in Dexmedetomidine than clonidine group. ($P < 0.0001$).

Systolic Blood Pressure:

Scheinin et al⁷ have proved that dexmedetomidine attenuates cardiovascular response to laryngoscopy and intubation by measuring catecholamine concentration and found that concentration of noradrenaline in mix venous plasma was less in dexmedetomidine group at all the phases of induction.

In our study we found that in group D there was no rise in mean SBP after 10 minutes of infusion (117.0 ± 6.00) from the baseline of 124 ± 8.45 ; whereas rise was found in group C from

122.60 ± 7.81 to 125.9 ± 7.81 . At induction mean SBP in group D was 111.80 ± 7.57 and in group C 124.50 ± 4.79 . ($P < 0.0001$) which was statistically highly significant. At intubation mean SBP in group D was 109.93 ± 7.62 and in group C it was 124.50 ± 4.79 ($P < 0.0001$) which was also statistically highly significant.

In our study observations were carried out till 110 minutes of surgery and at this time, mean SBP in group D was 92.33 ± 1.32 and mean SBP in group C was 121.09 ± 6.00 ($P < 0.0001$) This rise was statistically highly significant.

Higher efficacy of dexmedetomidine in Group D was evident by minimal changes from baseline SBP while in Clonidine group there was steep increase in SBP which was statistically highly significant.

Similar to systolic blood pressure, diastolic blood pressure also decreased after dexmedetomidine and clonidine administration but fall was more in group D compared to group C ($P < 0.0001$). It was statistically highly significant. This significant difference in DBP between two groups lasted throughout the procedure. In group D after 10 minutes of infusion of drug, DBP decreased from baseline level of 75.60 ± 5.15 to 69.87 ± 2.40 . However at induction it again reached to baseline of 75.60 ± 5.15 .

Mean Arterial Pressure: Mean MAP in group D after 10min infusion of Dexmedetomidine was 85.27 ± 2.71 compared with baseline mean MAP of 90.23 ± 4.36 and in group C mean MAP at baseline it was 89.36 ± 4.60 and after 10 minutes of infusion of clonidine was found to be 92.20 ± 4.54 . Similarly at induction in Group D MAP was -82.13 ± 4.57 , at intubation -79.33 ± 5.6 , and at 110 min -66.93 ± 3.03 whereas in Group C at induction -90.70 ± 4.97 , at intubation -91.83 ± 4.02 and at 110 min -88.43 ± 3.31 . The difference was highly significant statistically. ($P < 0.0001$).

In our study no patient had hypotension i.e. MAP < 60 mm Hg. It may be due to adequate fluid maintenance throughout the procedure, low dose of clonidine and dexmedetomidine given slowly in infusion over the period of 10 minutes.

Dexmedetomidine can result in hypotension due to vasodilation. A biphasic cardiovascular response has been described by **Bloor et al**⁸ after administration of Dexmedetomidine. Transient rise followed by fall in haemodynamic parameters is due to α_2 receptor stimulation of vascular smooth muscle. However this can be avoided by slow infusion of the drug over 10 min.⁹

Hypotension and bradycardia effects of α_2 agonists are presumably mediated by activation of α_2 adreno- receptor or imidazoline preferring receptors, or both in ventro lateral medulla specially nucleus tractus solitaries receptor. But low dose and slow infusion rate can keep hypotension and bradycardia within safety margin.¹⁰

The respiratory rate and SpO₂ was maintained in both the groups throughout the procedure. This may be related to use of low dose of drug used. No patient experienced postoperative nausea or vomiting in either group. No signs of aspiration or regurgitation were seen in our patient. This is probably due to the action of clonidine and dexmedetomidine on other organs containing α_2 receptors causing decreased salivation, secretion and gastric motility.¹¹ Dexmedetomidine enables smooth transition from time of administration of reversal to post extubation phase by suppressing CNS sympathetic activity, leading to higher safety of extubation as was observed in our groups D . However same safety of extubation was observed in clonidine group

Conclusion

From this study it is concluded that intravenous dexmedetomidine causes better maintenance of hemodynamic parameter as compared to clonidine. Dexmedetomidine decreases the central sympathetic out flow and modify intraoperative cardiovascular and endocrine response, to surgical stimuli and laryngoscopy.

However, more studies are needed to focus on its effects on patients.

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