Original Article

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Reduction in Anaesthetic Requirement and Better Perioperative Hemodynamic by Dexmedetomidine, in Spine Surgery

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Abstract

Aims and Objectives: The present study was conducted to know the efficacy of dexmedetomedine infusion on perioperative hemodynamics and reduction in anesthetic requirement during general anesthesia in spine surgeries.

Materials and Methods: After obtaining institutional ethical committee approval, the study was undertaken at Mahadevappa Rampure Medical College, Gulbarga. After obtaining informed written consent, 60 patients of ASA grade 1 & 2 were randomly allocated into two groups of 30 patients each,as Group C and Group D. The age group was 20-60 years of either sex undergoing elective spine surgery under GA. In group D, patients received dexmedetomidine as 1µg/kg over 10min before induction of anesthesia and maintained with 0.5-0.7µg /kg/hr infusion during anesthesia, and group C was taken as control. Hemodynamic changes and anesthetic requirement were recorded perioperatively.

Results: Dexmedetomedine causes significant reduction in heart rate and mean arterial pressure, blunted tachycardia and hypertensive response to intubation and extubation ($p<0.05$), maintained better hemodynamic intraopertively. Also it reduced the requirement of fentanyl(50%), and inhalational agent isoflurane (29-33%) during general anesthesia.

Conclusion: Dexmedetomedine reduces the requirement of opioids and inhalational agent during general anesthesia and provide stable hemodynamics intraoperatively.

Keywords: Dexmedetomedine; Fentanyl; General Anesthesia; Isoflurane.

Introduction

Dexmedetomidine, a highly selective α_2 agonist, have been used in the perioperative period for better hemodynamic stability. It possess sedative, anxiolytic and analgesic properties withoutcausing respiratory depression [1-4]. Also it reduces anesthetic and opioids analgesic requirementsduring perioperative period [5-7].

The mechanism of action of dexmedetomidine (dexmed) is unique, it causes presynaptic activation of the $\alpha_2$adrenoceptor, inhibits the release of norepinephrine, terminating the propagation of pain signals. Post synaptic activation of $\alpha_2$adrenoceptors in the central nervous system inhibits sympathetic activity and thus can decrease blood pressure(BP) and heart rate(HR). The analgesic effect of dexmed is different from opioids and can be used as an alternative to opioids in general anesthesia [8-10].

We carried out this prospective randomized controlled study to see the reduction in the requirement of isoflurane and fentanyl, and intraoperative hemodynamic stability by dexmedetomidine in lumbar spine surgeries during general anesthesia.

Materials and Methods

After obtaining institutional ethical committee approval, the study was conducted at MahadevappaRampure medical college, Gulbarga. An informed written consent was taken, 60 patients of ASA grade 1 & 2 were randomly allocated in two groups of 30 patients each, as Group C (control) and Group D (dexmed). Following patients were excluded, if patient has basal

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metabolic index more than 30kg/m^2, uncontrolled hypertension, severe respiratory disease such as asthama orischemic heart disease. All patients were premedicated with ondensetron 0.1mg/kg, midazolam 20µg/kg IV, induced with propofol 2mg/kg, vecuronium 0.1mg/kg IV and intubated. Anesthesia was maintained with O_2 and N_2O 50:50 in closed circuit system. In group D, patients received initial dose of dexmedetomedine as 1µg/kg over 10min before induction of anesthesia and then maintained with 0.5-0.7µg/kg/hras infusion during anesthesia. Group C patients received fentanyl 2µg/kg before induction, and Group D patients received 1µg/kg of fentanyl. Heart rate, blood pressure, inspired concentration of isoflurane were recorded before induction, intraoperatively at every 5, 10, 15, 20, 30, 40, 50, 60, 70, 80 and 90 min, and at extubation. Monitoring was done with ECG, NIBP, SPO_2, $EtCO_2$.

Heart rate and blood pressure were not allowed to increase more than 15% of the baseline values. If heart rate(HR) or mean arterial pressure(MAP) increases more than 15% of baseline values, Dexmed infusion titrated or fentanyl 1µg/kg was added or isoflurane concentration used to be increased by 0.1% in step wise manner. If HR and MAP still persists high, than other measures were taken to control it, and that case was excluded from the study. Heart rate of less than 50 beats/min was treated with ephedrine. MAP below 60mm of Hg was considered as hypotension and infusion dose of dexmed was reduced accordingly.

Dexmedinfusion andisoflurane was continued until the skin suture were initiated. Reversal was done with 0.01mg/kg glycopyrrolate and 0.05mg/kg of neostigmine IV, and patient extubated. Injparacetamol 1gm IV was given to all patients before extubation.

Statistical analysis was done with unpaired t-test and Kruskal-Wallis test. Chi-square test was used for categorical variables. Values were expressed as mean±SD, and a value <0.05 was considered as statistically significant.

Results

Both the groups were similar in terms of age, gender, weight and duration of surgery (around 80 mins). Before induction of anesthesia, HR and MAP were similar between the two groups. Intra operatively there was significant decrease in the HR and MAP in group D at all given time points compared to group C. Maximum average fall in MAP (6.8%) and HR (22.2%) was seen at 50min and 60 min, compared to baseline value, respectively, in group D, whereas there was average increase in HR (8.1%) and MAP (7.7%) at 5min after induction, compared to baseline value, in group C,.(P<0.05) Figure 1 and 2.

There was significant decrease in inspired isoflurane concentration, between 29-33%, at all time points, in group D as compared to group C (P<0.05) Figure 3. Also fentanyl requirement was less in group D, 1µg/kg, as compared to group C, 2µg/kg, (50% reduction) to maintain the HR and BP within the 15% of baseline values at all the time. In group D 5 patients developed bradycardia, and were treated with ephedrine, and 3 patients required supplemental analgesia.

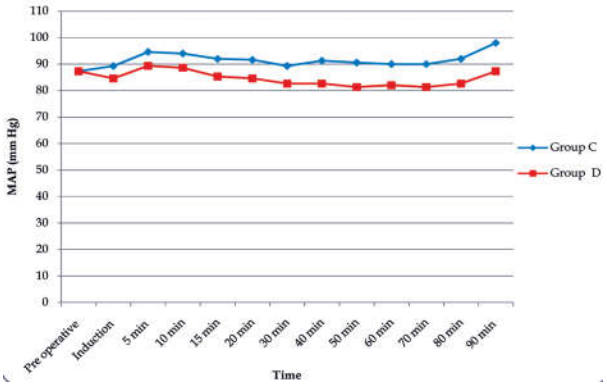

Fig. 1: Graph showing mean arterial pressure at different time points

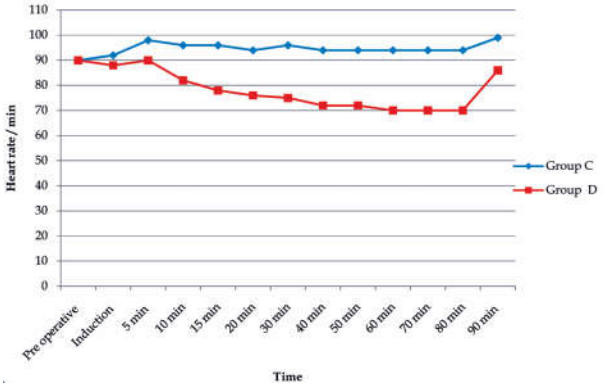

Fig. 2: Graph showing heart rate at different time points

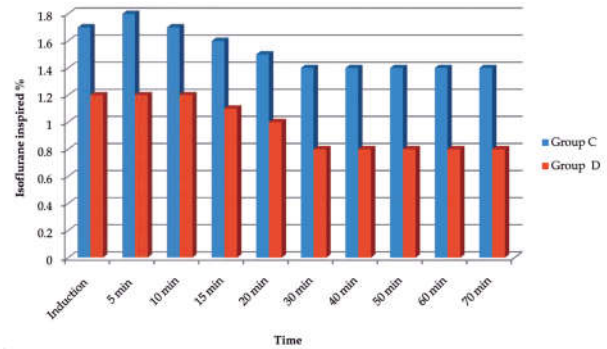

Fig. 3: Graph showing inspired concentration of Isoflurane at different time points

Discussion

The initial dose of dexmed blunts the pressor response to laryngoscopy and endotracheal intubation [11]. In our study also Dexmed reduced HR and MAP by an average of 8.1% and 5.6% respectively, following laryngoscopy, compared to control group. Dexmed also maintained better intraoperative hemodynamic compared to control group. In a study done byAhoM, et al [11] it showed that the increase in blood pressure or heart rate did not differ from that of the saline group. In our study HR and MAP were less at all time points compared to control group. It may be because we used 1μg/kg of fentanyl and dexmed dose was 0.5-0.7μg/kg compared to Aho et al study, where they did not use fentanyl and dexmed dose was 0.3 μg/kg.

Dexmed has been shown to reduce perioperative dose requirements for fentanyl [12] and isoflurane [13,14]. In our study there was reduction in the fentanyl requirement by 50% and isoflurane requirement by 33% throughout the intraoperative period. In a study conducted by Khan zp et al [15], showed 35 -50% reduction of maintainance concentration of isoflurane with low to high dose of dexmedetomidineon healthy human volunteers. This larger reduction in isoflurane requirement seen when compared to our study might be due to the higher doses of dexmed used in that study,(up to 2.85μg/kg/hr) and type of study group(volunteers).

In another study done by Chirag RP, et al [16], there was reduction in the fraction of inspired sevoflurane by 13%. This may be due to not using fentanyl in that study as compared to our study where we used 1μg/kg of fentanyl in dexmed group, further they have used entropy as assessment method, which may be better than hemodynamic monitoring.

Reduction in isoflurane requirement of our study, by 30%, is consistant with the study done by AhoM et al [11], done on patients undergoing abdominal hysterectomy. In this study they used hemodynamic monitoring for assessing depth of anaesthesia, similar to our study.

In our study there was reduction in fentanyl requirement by 50% in Dexmed group, because of opioid sparing effect. Aho MS et al [17], showed 33% decrease in morphine requirement with 0.4μg/kg dose of dexmed on patients undergoing tubal ligation. Cortinez et al [18], showed Dexmed when administered as infusion at a dose of 0.5μg/kg/hr has specific analgesic effect and provides visceral pain relief. Salman et al [19], showed Dexmed, when used as sole substitute for remifentanil in ambulatory gynecologic laparoscopic surgery, provides better peri-operative hemodynamic stability. Our study also showed better hemodynamic stability in the perioperative period by dexmed.

Our study has certain limitations like, we used hemodynamic monitoring as assessment tool for monitoring depth of anaesthesia, which is less reliable compared to BIS, EEG or entropy, or measuremenr of dexmed plasma concentration. These facilities are not available at our institute, and they are costly.

Conclusion

Dexmedetomidine provide better perioperative hemodynamic stability, blunts the pressor response to laryngoscopy and intubation. It also reduces opioid and inhalational agent requirement upto some extent during general anesthesia. For the better assessment of depth of anesthesia, BIS, entropy or plasma dexmed concentration to be used.

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