Original research article

Effects of Intravenous Dexmedetomidine and Fentanyl on Emergence Characteristics in Adult Patients Undergoing Laparoscopic Surgeries

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Abstract

Background : Emergence agitation (EA) presents clinically as disorientation, restlessness, excitation, inconsolability, unnecessary movement, incoherence and thrashing during the initial recovery from general anesthesia. Beneficial effects of dexmedetomidine (DEX) against emergence agitation (EA) in adults remain controversial.

Aim and Objective : To compare the effects of Dexmedetomidine and Fentanyl on emergence delirium and quality of recovery from general anaesthesia after laparoscopic surgeries. **Material and Method** : This was the Hospital based prospective, randomized double blind clinical trial. conducted on patients receiving IV dexmedetomidine versus IV Fentanyl among Patients undergoing laparoscopic surgeries under general anaesthesia. A Total 100 patients, allocated to two groups of 50 each (n=50), after following inclusion and exclusion criteria and getting informed consent form patients. p-value<0.01 was statistically significant.

Results: Mean difference between the group for age, Time duration at PACU, Duration of Surgery was assessed by using t-test, and difference in the proportion between the groups were assessed by using chi-square test for proportions. p-value less than 0.05 was consider statistically significant at 5% level of significance. time taken for verbal response was statically significant between the groups and this time was more in group D compared to Group F, also PACU stay was statistically significant and more time was taken in group D. Riker Sedation-Agitation Scale between the groups and we had more patients observed calm and cooperative in group D but in group F we have observed patients with agitated to dangerous agitation. **Conclusion**: Premedication with dexmedetomidine 1mcg/kg intravenously provides better quality and haemodynamic of extubation and reduces emergence agiation compared to fentanyl 1mcg/kg in adults undergoing laparoscopic surgeries.

Keywords : Emergence Agitation, Emergence Delirium, Riker Sedation-Agitation

Introduction

Emergence delirium (ED) refers to an acute state of confusion at the time of recovery from anesthesia.[1] ED manifests as hallucination, disorientation, restlessness and unexplained hyperactive physical behavior.[2,3] Emergence agitation (EA) presents clinically as disorientation, restlessness, excitation, inconsolability, unnecessary movement, incoherence and thrashing during the initial recovery from general anesthesia.[4] Although ED is not completely equivalent to EA, the terms ED and EA have been used interchangeably in some previous studies.[5-7] ED may present hypoactive signs or hyperactive signs or mixed forms

identical to agitation. In addition to this, the evaluation tools used for ED and EA are also same. for example Richmond Agitation-Sedation Scale or Riker Sedation-Agitation Scale.[1,8-10] However, it is important to distinguish ED and EA from postoperative delirium, which involves ED. ED reflects the early onset of postoperative delirium while in the operating room or on arrival at the PACU (postanesthesia care unit) just after the anesthesia period is over.[11,12] Dexmedetomidine, an α2-adrenergic agonist, is a sympatholytic drug which functions as an anxiolytic, sedative and analgesic. It is a well known agent for providing sedation without increasing the risk of respiratory depression when compared to other regularly used drugs like propofol or fentanyl. It can also deliver semi-arousable or co-operative sedation.[13,14] Originally, dexmedetomidine was approved for only upto 24 hours intravenous use in the adult intensive care unit (ICU) patients. However, over the past few decades, its uses have been expanded in the clinical practice.

Various studies have been conducted in the past to evaluate the efficacy of dexmedetomidine and fentanyl in reducing the ED in children, but very few studies have been reported in adult patients. Thus the present study was undertaken to compare the effects of Dexmedetomidine and Fentanyl on emergence delirium and quality of recovery from general anaesthesia after laparoscopic surgeries

Materials and Method

This was the Hospital based prospective, randomized double blind clinical trial. conducted on patients receiving IV dexmedetomidine versus IV Fentanyl among Patients undergoing laparoscopic surgeries under general anaesthesia. A Total 100 patients, allocated to two groups of 50 each (n=50), after following inclusion and exclusion criteria and getting informed consent form patients

Inclusion Criteria

1. Males and Female patients of American Society of Anaesthesiologists (ASA) physical status I/II.
2. Aged between 20 and 60 years.

Exclusion Criteria:

1. Patients with untreated and uncontrolled systemic illness,
2. Morbid obesity,
3. History of antipsychotic use/ known psychiatric disease
4. History of allergy to alpha adrenergic agonist
5. Metabolic disease and active gastrointestinal reflux.
6. Patients with Cardiac co-morbidities (QT abnormalities in ECG).

Study Groups:

Patients undergoing laparoscopic surgeries under general anaesthesia are divided into the following groups.

Group D – will receive Dexmedetomidine 1mcg/kg made into 50ml with normal saline infused intravenously (over 10 min) prior to termination of inhalational agent at the end of surgery and also a bolus of 10ml normal saline loaded in a 10ml syringe given slow IV (over 30seconds) at the same time.

Group F – will receive 50ml with normal saline infused intravenously (over 10 min) prior to termination of inhalational agent at the end of surgery and also a bolus of fentanyl 1mcg/kg iv diluted to10ml of normal saline loaded in a 10ml syringe given slow IV (over 30seconds) at the same time.

Method

Written and informed consent from patient regarding the study in his/her vernacular language and English. PAC and necessary investigations were done, one day prior to surgery. Patients were instructed standard nil per oral guidelines. After shifting to OT Standard monitoring for heart rate (HR), non‑ invasive blood pressure, respiratory rate and oxygen saturation (SpO2) were connected and measured. Preoxygenation with 100% oxygen was done for 3 minutes with facemask, As per the standard anaesthetic protocol, induction of anesthesia was done by injection propofol 2 mg.kg-¹ and inj. Fentanyl 2 µg.kg-¹. Tracheal intubation was facilitated by inj. vecuronium 0.1 mg/kg using appropriate sized cuffed ETT. Anaesthesia was maintained using sevoflurane 1% and N20 50% in O2 to maintain an end tidal CO2 of 30-45 mmHg. After intubation a nasogastric tube was passed for suctioning gastric secretions, air and to keep the stomach empty which was removed at the end of the surgery before extubation. Continuous monitoring of HR, systolic blood pressure (SBP), diastolic blood pressure(DBP), mean arterial pressure (MAP) and SpO2 were measured at baseline just (before induction of general anaesthesia), 10minutes after the start of surgery,30 minutes, end of surgery, 2minutes and 5 minutes after extubation. Dexmedetomidine has been started for group A at dose of 1 mcg/kg iv over 10min prior to termination of inhalational agents. Group B patients received fentanyl 1 mcg/kg iv 10 minutes prior to termination of inhalational agents. At the end of surgery, patient was given neuromuscular reversal agent injection neostigmine 0.05 mg/kg iv, inj.glycopyrrolate 0.01 mg/kg iv. After satisfying extubation criteria extubation was done. Sedation score was assessed at the time of extubation, 2 min, 5 min, after extubation and PACU(15min) using Riker sedation agitation score. Any adverse effects were noted

Table 1 : Riker Sedation-Agitation Scale

Score	Description	Explanation
7	Dangerous agitation	Tries to remove monitors and devices or climb out of bed; tosses and turns; lashes out at staff
6	Very agitated	Remains restless despite frequent verbal reassurance; bites endotracheal tube; requires restraint
5	Agitated	Anxious or restless; attempts to move; calms down with reassurance
4	Calm and cooperative	Calm; easy to arouse; able to follow instructions
3	Sedated	Difficult to awaken; responds to verbal prompts or gentle shaking but drifts off again
2	Very sedated	Incommunicative; responds to physical stimuli but not verbal instructions; may move spontaneously
1	Unarousable	Incommunicative; little or no response to painful stimuli

Statistical Analysis :

Collected data were entered into the Microsoft excel 2016, for further analysis, qualitative data were presented in the form of frequency and percentages, and quantitative data were presented in terms of mean and standard deviation. Mean difference between the group for age, Time duration at PACU, Duration of Surgery was assessed by using t-test, and difference in the proportion between the groups were assessed by using chi-square test for proportions. p-value less than 0.05 was consider statistically significant at 5% level of significance.

Results and Observation :

Table 2 : Distribution of Demographic profile between the groups

Parameter	Group D	Group F	Chi-square/t-test	P-value
Gender				
Male	18(36%)	23(46%)	1.033	0.309
Female	32(64%)	27(54%)		
Age				
Mean ± SD	38.45±4.12	39.75±3.78	1.644	0.1034
ASA Status				
ASA I	26(52%)	28(56%)	0.161	0.688
ASA II	24(48%)	22(44%)		
Duration of Surgery				
Mean ± SD	70.45±10.45	71.15±6.45	0.4031	0.68
Duration of Anaesthesia				
Mean ± SD	90.47±7.56	85.76±12.45	2.2865	0.0244(Sig)

Above table showed demographic profile between the groups and observed that, there was no significant difference observed in gender, age, ASA status and duration of surgery between the groups, but duration of anaesthesia was statistically significant between the groups.

In table 2 we have observed that time taken for verbal response was statically significant between the groups and this time was more in group D compared to Group F, also PACU stay was statistically significant and more time was taken in group D, and also statistically significant difference was observed in Riker Sedation-Agitation Scale between the groups and we had more patients observed calm and cooperative in group D but in group F we have observed patients with agitated to dangerous agitation.

Table 3 : Distribution of Demographic profile between the groups

Parameter	Group D	Group F	Chi-square	P-value
Time to Verbal Response				
Mean ± SD	11.45±1.46	7.69±3.76	6.59	<0.001(Sig)
Riker Sedation-Agitation Scale				
Score 1	10(20%)	7(14%)	23.701	<0.001 (Sig)
Score 2	12(24%)	3(6%)		
Score 3	5(10%)	8(16%)		
Score 4	22(44%)	13(26%)		
Score 5	1(2%)	13(26%)		
Score 6	0(0%)	3(6%)		
Score 7	0(0%)	3(6%)		
PACU Stay (Min)				
Mean ± SD	34.23±9.87	42.47±13.2	3.44	0.0008 (Sig)

Discussion :

Delirium is an acute confusional state wherein the patients cognitive functioning is impaired with inability to process awareness of environment and attention. Most patients transition to normal consciousness smoothly, after the anaesthetic agents are disconnected at the end of a surgical procedure. Emergence agitation has been reported in up to 20% of adult patients after general surgery. Male gender, type of surgery, inhalation anaesthetics, presence of tracheal tube and preoperative benzodiazepine medication are risk factors for postoperative agitation in adults.[1] Emergence agitation is especially common after ENT surgery, where

55.4% of patients experienced agitation. High incidence of emergence agitation after ENT surgery may be attributable to a sense of suffocation. A select few patients may end up having emergence delirium with the risk being higher in paediatric age groups and elderly population. Amongst the numerous agents available, dexmedetomidine has found to be beneficial, especially in sevoflurane-induced emergence delirium. Various pharmacological measures have been used to reduce the incidence of EA in children anesthetized with sevoflurane, desflurane or both. In a meta-analysis, it was found that ketamine, fentanyl, propofol, α2 agonist and providing peroperative analgesia were effective in preventing EA [2]. Dexmedetomidine is a highly selective α2 agonist which produces sedation and anxiolysis through reduction in sympathetic central nervous system activity. It has a major advantage over other sedatives that it is associated with minimal respiratory depression. Moreover, its activation of α2 receptors accentuates the action of opioids and decreases opioid consumption [3].

At a dose of 0.5 μg/kg, dexmedetomidine is beneficial in reducing the incidence of emergence delirium and negative postoperative behavioural changes (NPOBC). Caution must be exercised with vigilant cardiopulmonary monitoring when dexmedetomidine is administrated after induction of anaesthesia.

In the study we have observed that majority of female patients were observed in our study compared to the male patients and this difference in the proportion the male and female between the group was statistically not significant (p-value =0.309), mean age of the patients were comparable and statistically found not significant between the groups (p-value =0.1034), also It was observed that mean age of the patients form group D was more compared to group F. These results were supported by Nair et al.[15] Marian Greiss et al[16] supported our study in case of duration of surgery which was comparable in their study (p-value = 0.354), duration of surgery depends on the response of patients and skill acquires by the surgeon to do it. Systolic blood pressure and diastolic blood pressure also found similar to heart rate and mean arterial pressure significant at 10 minutes and remained significant and lower in group D compared to group F. Similar to our study, patients undergoing elective laparoscopic surgeries had hemodynamic changes that were better controlled with dexmedetomidine than with fentanyl [12, 13].

In our study we have used Riker Sedation Agitation Scale to know about emergence agitation, it's a 7 score scaling which tells about unarousable to dangerous agitation. Our study found that out of all patients form group D, majority of each of 44% of the patients were calm and cooperative and very sedative, followed by unarousable and sedative, only one patients from group D found with agitation, but we didn't found any of the patients with very agiated and dangerous agitation. That of in group F we have found 3 patients with dangerous agiation and 5 patients with very agitated. Also we have observed 19 agitated to dangerous agiation patients in group F and 31 patients were calm and cooperative to arousable found in group F. This difference in the proportion of agiation between the groups was statistically significant (P-value <0.001). Study by Kim et al.[17] observed that the incidence of emergence agitation was lower in Group D than in Group C (28% vs 52%, p=0.041), while dangerous agitation was not different between the groups.
Our study found that mean difference in the time to verbal response was more in dexmedetomidine group compared to fentyl group and this difference between the group was statistically significant (p-value <0.001). study by Kim et al observed that there was longer mean duration for verbal response of the patients in group D compared to the control group.

Mean difference in PACU (Min) was longer in group F compared to the group D, and this difference between the group was statistically significant(p-value<0.05), this difference in fentyl group, because of more agitation in this group compared to dexmedetomidine group. Study by Kim et al found that no patient had agitation in the PACU and two patients in Group D had residual sedation (sedation-agitation scale score=3, difficult to arouse but awakens to verbal stimuli or gentle shaking) at arrival in the PACU. However, these two patients were fully awake 10 min after arrival and stayed in the PACU for 15 and 26 min, respectively. Their lengths of PACU stay were clinically acceptable.

Conclusion :

Intraoperative dexmedetomidine infusion reduces the incidence of EA in immediate postoperative period in adult patients undergoing laparoscopic surgeries. However, it could lead to delayed recovery in terms of prolonged time to extubation, time to patient response on verbal command, and time to discharge from post anaesthesia care unit. Our study supports dexmedetomidine 1 mcg/kg made into 50ml with normal saline administration as a sole intraoperative analgesic agent for adult patients without comorbidities undergoing elective laparoscopic surgeries based on its ameliorating effect on the surgical stress response, the postoperative pain, and the perioperative analgesic consumption. Further studies are needed to evaluate dexmedetomidine effect on other surgical stress response markers.

Acknowledgement : None

Funding: None

Conflict of Interest : None

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