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Original Research Article

A Comparative Study between Propofol and Dexmedetomidine for the Reduction of Etomidate Induced Myoclonus in Patients Undergoing General Anesthesia for Supra Umbilical Surgery

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Abstract:

Introduction: General anesthesia has been the gold standard and backup form of anesthesia for all surgical procedures since the beginning of anesthesia, when it was a field with few resources and equipment. The well-known induction medication etomidate, is used extensively for induction and has a better stable cardiovascular profile with fewer respiratory adverse effects than propofol. Despite being regarded as a safe induction drug with a little risk of hypotension, etomidate has two common side effects: myoclonus and injection pain.

Aims: A comparative study between dexmedetomidine and propofol in reduction of etomidate induced myoclonus in patients undergoing general anesthesia for supraumbilical surgery.

Materials & Methods: This is a prospective, comparative, observational study. Place of study and Duration: Nil Ratan Sircar Medical College and Hospital, Kolkata, West Bengal. This study was conducted over a period of 18-month (Jan 2019- July 2020) and total sample size 80 patients.

Result: In our study mean duration of myoclonus at first, second, and third minutes of our investigation revealed significant difference between the ED (Dexmedetomidine group) and EP (Propofol group). The mean duration of myoclonus at first, second, and third minute readings of ED were 1.675, 1.425, and 1.15, respectively. At EP, on the other hand, there was a notable rise to 3.975 in the first minute, a little rise to 1.625 in the second, and a fall to 0.7 in the third. These findings point to a noticeable initial peak in the first minute at EP, which was followed by a slow drop in the minutes that followed. There is also notable early increase in symptom severity at EP1, followed by a significant reduction in symptoms by EP3.

Conclusion: The study led us to conclude that both propofol and dexmedetomidine are effective in reducing the incidence and severity of etomidate-induced myoclonus in patients undergoing general anesthesia for supra-umbilical procedures. However, dexmedetomidine had a stronger effect than propofol, with increased hemodynamic stability and a significantly lower incidence of myoclonus.

Keywords: Etomidate, Myoclonus, Propofol, Dexmedetomidine, General anesthesia and Supra-umbilical surgery.

Introduction

General anesthesia has been the gold standard and backup form of anesthesia for all surgical procedures since the beginning of anesthesia, when it was a field with few resources and equipment. Today, anesthesiologists and surgeons collaborate to plan every surgical procedure. Even though neuraxial anesthesia has essentially supplanted general anesthesia, particularly in the obstetric population, its disadvantages—most notably hypotension—make it a less acceptable alternative for critically ill and hemodynamically impaired patients. Since general anesthesia (GA) induction agents were first developed, no perfect induction agent has been created that can provide hemodynamic stability during endotracheal intubation with few or no negative side effects. In order to achieve sleep, forget-

fulness, analgesia, skeletal muscular relaxation, and loss of autonomic nervous system reflexes, GA is achieved by combining intravenous medications with inhalational gases. These days, different classes of intravenous inducing drugs are utilized in different formulations and doses, with varying induction characteristics and serious adverse effects such as respiratory depression, allergy, hypotension, bradycardia, cardiac arrest, and variable medication interactions. Thus, thiopentone sodium, propofol, ketamine, midazolam, and other regularly used IV induction medications each have their own drawbacks and adverse effects, and none of them have been shown to be the best or most optimal. Hypotension and cardiac depression are possible side effects of using propofol as the preferred drug during daycare surgery.

The well-known induction medication etomidate, which has a short half-life and a rapid beginning of action, is used extensively for general induction and has a better stable cardiovascular profile with fewer respiratory adverse effects than propofol. [1,2] Despite being regarded as a safe induction drug with a little risk of hypotension, etomidate has two common side effects: myoclonus and injection pain [3] [4]. The novel fat emulsion of etomidate has reduced injection pain [5].

The clinical issue of etomidate- induced myoclonus during anesthesia induction remains unresolved. Up to 85% of patients who were not on medication experienced myoclonus, which is characterized by abrupt, short, involuntary muscle twitches that can be irregular or rhythmic. Patients with open-global injuries, non-fasted emergency patients, or those with low cardiovascular reserves may experience severe consequences from myoclonus.[6]

Material and Methods

Type of Study: This is a prospective, comparative, observational study

Place of study and Duration: Nil Ratan Sircar Medical College and Hospital, Kolkata, West Bengal. This study was conducted over a period of 18-month (Jan 2019- July 2020).

Sample Size: 80 patients.

Group EP: This group received bolus injection propofol as premedication before induction with etomidate. Dose = 0.5 mg per kg body weight in miligram.

Group ED: This group received infusion of injection Dexmedetomidine before induction with inj etomidate .Dose = 0.5 mcg per kg body weight

Exclusion Criteria:

- Neuropsychological disease
- Adrenal cortex dysfunction
- Congestive heart failure
- Renal, pulmonary, hepatic or endocrinal diseases
- History of allergic reaction to the study drugs
- Patients who had received analgesics, sedatives within the previous 24 hours
- Hiatal hernia and symptomatic gastro esophageal reflux.
- Pregnant or lactating women

Inclusion Criteria:

- ASA I-II
- Age 18-60 years of Age
- Scheduled for elective supra umbilical procedure
- Patients aged between 19 - 59 years
- Body mass index (BMI) in 18-24.99 range.

Statistical Analysis: For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analyzed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests were used to compare independent groups, while paired t-tests accounted for correlations in paired data. Chi-square tests (including Fisher's exact test for small sample sizes) were used for categorical data comparisons.

Result

Table 1: Comparing the occurrence of mild, moderate and severe myoclonus in ED and EP groups

	ED1	EP1	ED2	EP2	ED3	EP3
Mild	29(72.5%)	25(62.5%)	24(60%)	26(65%)	19(47.5%)	9(22.5%)
Moderate	0	12(30%)	0	0	0	1(2.5%)
Severe	0	1(2.5%)	0	0	0	0
Nil	11(27.5%)	2(5%)	16(40%)	14(35%)	21(52.5%)	30(75%)

Table 2: Table of distribution of baseline heart rate between the two groups

	Mean H/R	Median H/R	Standard Deviation	Max H/R	Min H/R
EP H/R	89.5	90	7.76	116	68
ED H/R	85.8	88	11.29	112	68

Table 3: Table of distribution of baseline blood pressure

	Mean (BP)	Median (BP)	Standard (Deviation)	Max (SBP/DBP)	Min (SBP/DBP)
EP	128/74	128/78	10.46/12.17	148/90	110/52
ED	132/78	134/76	10.69/6.62	150/92	112/66

Table 4: Comparing the mean duration of myoclonus in each group

	1ST MIN	2ND MIN	3RD MIN
ED	1.675	1.425	1.15
EP	3.975	1.625	0.7

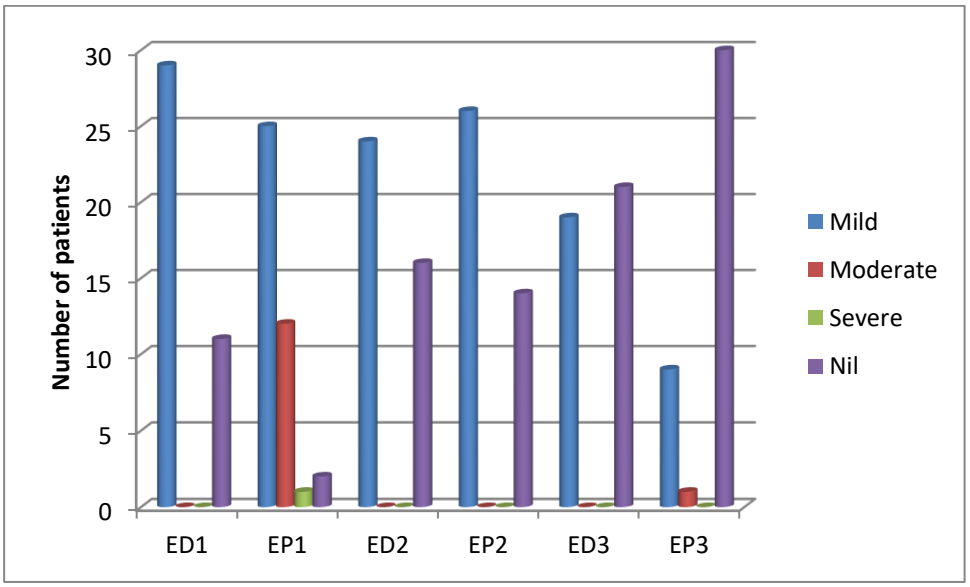

Figure 1: Comparing the Occurrence of Mild, Moderate and Severe Myoclonus in ED and EP Groups

In our study, we observed changes in symptom severity across three evaluation points (ED1 vs EP1, ED2 vs EP2, and ED3 vs EP3), focusing on Mild, Moderate, and Severe categories. At ED1, 29 participants (72.5%) were categorized as Mild, while at EP1, Mild cases decreased to 25 (62.5%) with an increase in Moderate (12; 30%) and Severe (1; 2.5%) cases, showing a statistically significant difference ($p = 0.00001$). At ED2, 24 participants (60%) were Mild, and at EP2 this slightly increased to 26 (65%), with no reported Moderate or Severe cases, indicating no significant change ($p = 0.62$). By ED3, Mild cases further decreased to 19 (47.5%), and at EP3 they dropped to 9 (22.5%) with the presence of 1 Moderate case (2.5%), again reflecting a statistically significant shift ($p = 0.0045$).

These results suggest a notable early increase in symptom severity at EP1, followed by a significant reduction in symptoms by EP3.In our study, the mean heart rate (H/R) showed an increase from the ED to EP , with ED HR 85.8 ± 11.29 and EP HR 89.5 ± 7.76.In our study, the mean blood pressure (BP) showed a slight decrease from ED to EP with ED BP at $132/78 \pm 10.69/6.62$ and EP BP at $128/74 \pm 10.46/12.17$.In our study, mean duration of myoclonus observed across the three minutes showed a clear shift between ED and EP. At ED, the values were 1.675 in the first minute, 1.425 in the second minute, and 1.15 in the third minute. At EP, there was a significant increase in the first minute (3.975), followed by a slight rise in the second minute (1.625), and a decrease in the third minute (0.7). These results suggest that while there was a notable spike at EP in the first minute, the values decreased thereafter, indicating a time-dependent variation in the measurements between the two time points.

Discussion

In similar study by Luan HF et al [7] (2015) showed that the median myoclonus grade for severity was 1 (mild) in the propofol group, 2 (moderate) in the saline group, and 1 (mild) in the dexmedetomidine group. $P = 0.02$ indicated that these differences were statistically significant. We found that the severity levels in our study changed significantly over time. Eleven (27.5%) and 29 (72.5%) subjects were classified as Nil and Mild, respectively, at ED1.

By EP1, there were 25 mild cases (62.5%), 12 moderate cases (30%), 1 severe case (2.5%), and 2 nil cases (5%). At ED2, 24 (60%) were classified as Mild, and 16 (40%) as Nil. By EP2, Mild slightly increased to 26 (65%), while Nil decreased to 14 (35%). A tendency toward improvement was seen by ED3, where 19 (47.5%) were classified as Mild and 21 (52.5%) as Nil. Lastly, at EP3, Nil dramati-

cally grew to 30 (75%), whereas Mild dropped to 9 (22.5%). According to these findings, the majority of participants' severity levels significantly improved, especially by EP3, and there was a noticeable trend towards Nil severity.

In others study by Dey S, et al [8] (2018) showed that In particular, myoclonus occurred in 26% of patients in the dexmedetomidine group, compared to 64% in the saline group and 12.5% in the propofol group. The median myoclonus grade for severity was 1 (mild) in the propofol group, 2 (moderate) in the saline group, and 1 (mild) in the dexmedetomidine group. P = 0.02 indicated that these differences were statistically significant. In our study, the EP H/R had a mean of 89.5 ± 7.76, while the ED H/R had a higher mean and standard deviation value of 85.8 ± 11.29. As evidenced by the higher standard deviation, this suggests that the ED H/R not only had a little lower mean but also demonstrated more variability in heart rate readings.

In similar study by Du X et al [9] (2017) showed that The median myoclonus grade for severity was 1 (mild) in the propofol group, 2 (moderate) in the saline group, and 1 (mild) in the dexmedetomidine group. P = 0.02 indicated that these differences were statistically significant. The blood pressure (BP) mean ± standard deviation data in our study indicated minor variations between ED and EP .

The mean blood pressure was 132/78 ± 10.69/6.62 at ED and 128/74 ± 10.46/12.17 at EP. This suggests a little drop in the diastolic and systolic blood pressure at EP. Furthermore, the standard deviation for diastolic blood pressure was higher at EP, indicating greater variability in diastolic measures at the evaluation point, whereas the standard deviation for systolic blood pressure was marginally lower at EP than at ED, indicating less variability in systolic readings at EP.

We showed that mean duration of myoclonus recorded in the first, second, and third minutes of our investigation revealed significant difference between the ED and EP. The first, second, and third minute readings at ED were 1.675, 1.425, and 1.15, respectively. At EP, on the other hand, there was a notable rise to 3.975 in the first minute, a little rise to 1.625 in the second, and a fall to 0.7 in the third. These findings point to a noticeable initial peak in the first minute at EP, which was followed by a slow drop in the minutes that followed.

Conclusion

The results of the study led us to conclude that both propofol and dexmedetomidine are effective in reducing the incidence and severity of etomidate-induced myoclonus in patients undergoing general anesthesia for supra-umbilical procedures. However, dexmedetomidine had a stronger effect than propofol, with increased hemodynamic stability and a significantly lower incidence of myoclonus. Bradycardia and hypotension were two minor side effects of dexmedetomidine. As per its effectiveness and safety record, dexmedetomidine might be the better pretreatment medication in elective surgical settings. By lowering etomidate-related issues during induction, this will contribute to increased procedural safety and general patient comfort.

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