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Comparison of lignocaine and nitrous oxide in reducing pain due to Rocuronium injection: A prospective observational study

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Abstract

Background and Objectives: Rocuronium bromide is used in anaesthesia to endotracheal intubation and skeletal muscle relaxation. Rocuronium causes pain on parenteral injection as a common adverse effect. In this prospective observational study pre-treatment with lignocaine and nitrous oxide used to reducing the adverse effect i.e pain of Rocuronium injection.

Methodology: A prospective observational study was conducted on 200 patients those underwent modified radical mastectomy and thyroidectomy under general anesthesia were randomly assigned in to two groups (Group L and Group N). Group L (n=100) received 4ml of 1% intravenous preservative free Lignocaine followed by a sub-paralysing dose of intravenous Rocuronium 0.06 mg/kg, diluted with normal saline to an injection volume of 5ml over 10 seconds. Group N received 50% Nitrous oxide in oxygen for 2 minutes followed by a sub-paralysing dose of intravenous Rocuronium 0.06 mg/kg, diluted with normal saline to an injection volume of 5ml over 10 seconds. Pain in the arm, and their response was assessed according to McCrirrick and Hunter scale).

Results: It was observed that both lignocaine (Group L) and Nitrous oxide (Group N) reduced Rocuronium injection pain similarly (82% vs 91%; $P > 0.05$).

Conclusion: In our study we had compared the effect of 40mg 1% Intravenous preservative free lignocaine and Inhalational 50% Nitrous oxide in reducing pain due to Rocuronium injection and found that both were equally effective in reducing pain of Rocuronium injection.

Keywords: Lignocaine, nitrous oxide, rocuronium, pain, mccrirrick and hunter scale

Introduction

Normally Neuromuscular agents used in modern anaesthetic practices for tracheal Intubation and maintenance of Muscle relaxation in general anaesthesia ^[1]. One of such agent is succinylcholine. It is a depolarizing neuromuscular blocking drug and very frequently used for rapid Sequence Induction. It is having rapid onset of action, optimum muscle relaxation and shorter duration of action. The side effects include hyperkalemia, postoperative myalgia, life-threatening arrhythmia, malignant hyperthermia and increase in intracranial pressure, intragastric pressure or intraocular pressure. Administration to the healthy adolescents and children, may cause dysrhythmia and cardiac arrest, who were later found to have undiagnosed Duchenne muscular dystrophy ^[1].

Rocuronium bromide is a widely used aminosteroidal non-depolarising neuromuscular blocking agent with a fast onset and intermediate duration of action. At a given dose of 0.60 to 1.20 mg/kg its onset of action is within 45 seconds to 90 seconds, which is similar to that of succinylcholine ^[2]. Therefore, Rocuronium is used as a substitute to succinylcholine for tracheal intubation. The main disadvantage of Rocuronium is the pain at its injection areas, the root cause of this largely not known ^[3, 4].

Objectives of the study

- To compare the effectiveness of 40mg 1% Intravenous preservative free Lignocaine and 50% Inhalational Nitrous Oxide with 50% Oxygen in reducing severity of pain during subparalysing dose of (0.06mg/kg) Rocuronium Bromide Injection.
- To compare the withdrawal movements if any, after intubating dose of rocuronium (0.6 mg/kg)

Methodology

Patients of gd-1 and gd-2 ASA, aged 20 -60 years, undergoing elective surgeries in Medical College Hospital, Thrissur.

Inclusion criteria

- Grade I and II Subjects of ASA
- Age group 20-60 years
- Patients undergoing elective modified radical mastectomy or thyroidectomy

Exclusion criteria

Patients with

- known allergy to local anaesthetics
- known allergy to rocuronium
- bronchial asthma
- chronic obstructive pulmonary disease
- chronic pain
- thrombophlebitis
- anticipated difficult airway
- pregnancy
- contraindications to N₂O
- patients receiving analgesics

Study procedure

A prospective observational study was conducted on 200 patients. After obtaining permission from Institutional Ethics Committee, a written informed consent in local language was taken. American Society of Anesthesiologists physical status I and II, aged between 20 and 60 years female patients decided to undergo modified radical mastectomy and thyroidectomy under general anesthesia were included in this study.

A detailed pre-anesthetic check-up was done. Pre-operative fasting of minimum 8 hrs ensured before surgery. All patients were given premedication with tablet alprazolam 0.5 mg orally the night before surgery. The patients were given tablet ranitidine 150 mg and tablet metoclopramide 10 mg on the previous night and in the morning. pre-operative check done before surgery while detailing procedure. A McCrerrick and Hunter scale for pain (0-no pain and 4-worst pain imaginable) was also explained. All patients were investigated for Hb%, total leucocyte count, differential leucocyte count, platelet count, blood sugar, blood urea, serum creatinine and liver function tests. Electrocardiography (ECG) and chest X-ray were also be taken.

All these patients who receive intravenous preservative free Lignocaine prior to Rocuronium injection were classified as Group (L) and those who receive inhalational Nitrous oxide with Oxygen prior to Rocuronium injection were classified as Group (N).

In the operative room, standard intra-operative monitors ECG, pulse oximeter, non-invasive blood pressure (NIBP) were attached and baseline parameters were recorded. One 20G cannula was placed and the patient was started on a crystalloid. All patients were premedicated with injection midazolam 0.02 mg/kg body weight intravenously, injection glycopyrrolate 0.005 mg/kg body weight intravenously, injection ondansetron 0.1 mg/kg body weight in the intravenous fluid as slow infusion.

Group (L) patients received 4ml of 1% intravenous preservative free Lignocaine after occlusion of the forearm

with a tourniquet (upto 70 mm Hg) to occlude the vein and after 1 minute followed by a subparalysing dose of intravenous rocuronium 0.06 mg/kg over 10 seconds (diluted with normal saline to an injection volume of 5 ml) [12]. Group (N) patients received inhalation of 50:50 Nitrous oxide with Oxygen for 2 minutes followed by a subparalysing dose of intravenous rocuronium 0.06 mg/kg over 10 seconds, (diluted with normal saline to an injection volume of 5 ml over 10 seconds). The patients were observed and asked immediately if they had pain in the arm, and their response were assessed according to McCrerrick and Hunter scale [13].

Assessment of pain during injection of Rocuronium according to McCrerrick and Hunter scale Anaesthesia was then induced with injection thiopentone sodium 5 mg/kg. When the response of eyelash stops, an intubating dose of rocuronium 0.6 mg/kg was injected over 10 seconds and withdrawal movements, if any, were recorded. Any adverse effects were also to be noted. At the end of surgery, residual neuromuscular block was antagonized with injection neostigmine 0.05mg/kg body weight and injection glycopyrrolate 0.005mg/kg body weight intravenously.

Results & observations

The observations made were entered in Microsoft excel and tabulated. The data were analysis done using SPSS statistics 22.0 software. P value < 0.05 was considered significant.

The data were expressed in its frequency, percentage, mean and variance. Comparisons done by Chi square (X²) test was used as nonparametric test. Independent t test was wont to compare mean values between groups for parametric data. For all statistical evaluations, a two-tailed probability useful, < 0.05 was considered significant. The patients in both Lignocaine groups and Nitrous oxide group did not differ significantly on baseline variables or patient characteristics.

Table 1: Age distribution among two groups

Group	Mean age	Mean difference	P value
Lignocaine	40.47± 9.7	2.25	0.297
Nitrous oxide	42.72± 9.0		

- Mean age in study population was 41.6 with standard deviation 9.45
- The difference in mean age between Lignocaine and Nitrous oxide groups were calculated with t-test and found to be statistically insignificant

Table 2: Weight distribution among two groups

Group	Mean weight	Mean difference	P value
Lignocaine	57.57± 8.2	0.920	0.670
Nitrous oxide	56.65± 8.5		

- Mean weight in study population was 57.11 with standard deviation 8.43
- The difference in mean weight between lignocaine and nitrous oxide groups were calculated with t-test and found to be statistically insignificant

Table 3: Distribution of population according to the presence of 3a. Withdrawal

Withdrawal	Frequency	Percent
Absent	194	97%
Present	6	3%
Total	200	100

- Withdrawal distribution in the study population showed 97% of patients had no withdrawal and 3% of patients had withdrawal.

Table 4: Pain

Pain	Frequency	Percent
Absent	173	86.5%
Mild	19	9.5%
Moderate	8	4%

- Pain distribution in the study population showed 86.5% of patients had no pain, 9.5% of patients had mild pain and 4% of patients had moderate pain Among the study population none of them developed severe pain

Table 5: ASA-PS

ASA-PS	Frequency	Percent
Class- I	30	15%
Class- II	170	85%
Total	200	100

- ASA-PS distribution in the study population showed 15% of patients belonging to grade 1 and 85% of patients belonging to grade 2.

Table 6: Comparison of pain between Lignocaine & Nitrous oxide 4a.) Presence of pain

Group	Pain		total
	Absent	Present	
Lignocaine	82 (82%)	18 (18%)	100
Nitrous oxide	91 (91%)	9 (9%)	100

$X^2 = 3.468$ $p = .097$

There is no significant difference among Lignocaine group & Nitrous oxide group in reducing pain due to rocuronium injection.

Table 7: Comparison of presence of withdrawal

Group	Withdrawal		Total
	Absent	Present	
Lignocaine	96 (96%)	4 (4%)	100
Nitrous oxide	98 (98%)	2 (2%)	100

$X^2 = 0.687$, $p = 0.683$

There is no significant difference among group L & group N in reducing withdrawal movements due to rocuronium injection

Table 8: Comparison of severity of pain

Group	Pain			Total
	No pain	Mild pain	Moderate pain	
Lignocaine	82 (82%)	13 (13%)	5 (5%)	100
Nitrous oxide	91 (91%)	6 (6%)	3 (3%)	100

$X^2 = 3.547$, $p = 0.170$

There is no significant difference among group L & group N in reducing pain due to rocuronium injection. Among the study population none of them developed severe pain.

Table 9: Comparison of ASA-Physical status & Pain:

Group		Pain			Total
		No pain	Mild pain	Moderate pain	
Lignocaine	ASA-I	93.3%	6.7%	0%	100.0%
	ASA-II	80.0%	14.1%	5.9%	100.0%
Nitrous oxide	ASA-I	86.7%	6.7%	6.7%	100.0%
	ASA-II	91.8%	5.9%	2.4%	100.0%

Lignocaine group - $X^2 = 1.703$, $p = 0.427$

Nitrous oxide - $X^2 = 0.840$, $p = 0.657$

There is no significant difference in distribution of ASA-PS and pain among Nitrous oxide group & Nitrous oxide group Among the study population none of them developed severe pain

Discussion

Pain on intravenous injection of rocuronium is an undesirable effect [5]. polymodal nociceptors receptors responsible for pain in veins for injection of anesthetic drug [6].

N-methyl d-aspartate receptor antagonists have the potential for attenuating central sensitization and preventing neuroplasticity Sivakumar, *et al.* studied on a total of 80 adult patients of American Society of Anaesthesiology physical status I/II, who underwent elective surgery. They compared the effect of nitrous oxide and lignocaine on the incidence of pain after subparalyzing dose of rocuronium [7]. Group O received 100% oxygen and 2% lignocaine 2ml, Group N received 50% nitrous oxide with 50% oxygen mixture and 2% lignocaine 2ml and assessed the response to subparalyzing dose of rocuronium. They found that 95% of group N patients showed no pain, however 25% of group of patients showed pain. This difference was found to be statistically significant.

Our study included 200 patients divided into two groups using random number table. These patients were to receive either 40mg of 1% lignocaine hydrochloride or 50% Nitrous oxide & 50% oxygen before receiving intravenous rocuronium bromide. The groups were comparable in age, weight and ASA physical status.

Mean age of Lignocaine group was 40.47 ± 9.7 and of Nitrous oxide group was 42.72 ± 9.0 and the difference in mean age between 2 groups was not statistically significant. Mean weight of Lignocaine group was 57.57 ± 8.2 and of Nitrous oxide group was 56.65 ± 8.5 and the difference in mean weight between 2 group was not statistically significant t test.

In this study total number of patients belonging to ASA PS I was 30 (15%) and the total number of patients belonging to ASA PS II was 170 (85%). There were 15 patients belonging to ASA PS I (15%) and 85 patients belonging to ASA PS II (85%) in Lignocaine group [8]. Nitrous oxide Group had 15 patients belonging to ASA PS I (15%) and 85 patients belonging to ASA PS II (85%) which is same in study of sharma *et al.* [9]. The distribution of ASA physical status between the two groups was not statistically significant.

In this study 82% of patients in Lignocaine group had pain score 0 similar to the study conducted by Sharma *et al.* [10], while in Nitrous oxide group 91% of patients had pain score 0. In Lignocaine group 13% of patients had pain score 1 while in Nitrous oxide group 6% of patients had pain score 1.

In Lignocaine group 5% of patient had pain score 2 while in Nitrous oxide group 3% of patients had pain score 2. In both the groups no patient had a pain score 3.

The pain scores were statistically analyzed using Chi-square test which showed that the scores were not significantly different ($P = 0.097$). The severity was also analyzed among the groups which was not significantly different ($P = 0.170$)^[11].

Conclusion

In our study we compared the effect 40mg 1% Intravenous preservative free lignocaine and Inhalational 50% Nitrous oxide in reducing pain due to rocuronium injection and found that both were equally effective in reducing pain of rocuronium injection.

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