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DEPARTMENT OF ANESTHESIA

COMPARISON OF DEFASCICULATION DOSE OF VECURONIUM AND INTRAVENOUS LIDOCAINE FOR PREVENTING SUCCINYLCHOLINE INDUCED MUSCLE FASCICULATION AND POST-OPERATIVE MYALGIA AMONG ADULT SURGICAL PATIENTSAT TIKUR ANBESSA SPECIALIZED HOSPITAL 2022/23: A PROSPECTIVE COHORT STUDY.

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Declaration

I, the undersigned declare that this thesis is my original work in partial fulfillment of the requirements for the Master of Science degree in anesthesia. All directly quoted material has been appropriately referenced and any assistance that has been done during this time has been given an acknowledgement.

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ACRONYMS

TASH	Tikur Anbessa Specialized Hospital
ASA	American Society of Anesthesiologist
BMI	Body mass index
BSC	Bachelor of Science
DMRs	Depolarizing muscle relaxants
GA	General Anesthesia
I.V	Intravenous
NDMRs	Non-depolarizing muscle relaxants
POM	Post-operativemyalgia
RSI	Rapid sequence induction
SCh	Succinylcholine
ICP	Intracranial pressure
IOP	Intraocular pressure
POP	Postoperative

Abstract

Background: *Because of its inexpensive cost, quick start, quick duration of action, and profound muscular relaxation, succinylcholine is commonly utilized, but it also has a number of side effects, such as fasciculation, postoperative myalgia, and an elevation in serum potassium. It may cause the patient to feel worse than the discomfort from the surgical site, especially for day-case patients whose discharge from the hospital could be delayed by postoperative myalgia. There is no known cure for succinylcholine-induced myalgia because the genesis of the condition is poorly understood.*

Objective: *To Compare the defasciculation dose of vecuronium and intravenous lidocaine for preventing succinylcholine-induced muscle fasciculation and post-operative myalgia among adult surgical patients at Tikur Anbessa Specialized Hospital 2022/23.*

Methods*: A prospective cohort studywascarried out on 88 adult surgical patientswho underwentelective surgery under general anesthesia with succinylcholine. The study participantswererandomlysplit into twogroups, according to pre-treatment with Vecuronium 0.01mg/kg and IV lidocaine 1.5mg/kg. Then,the severity of fasciculation and myalgia on postoperative day 1was recorded. Analysiswasdone byusing SPSS version 25 software and statistical analysis was done by independentt-test and chi-square test. P<0.05 was considered statistically significant*

Results: *In the defasciculating dose of vecuronium and IV lidocaine groups, respectively, the overall incidence of succinylcholine-induced fasciculation was 11 (25%) and 32 (72%) correspondingly. In the defasciculating dose of the vecuronium group compared to the IV lidocaine group, the intensity of fasciculation was lessened more (p=0.0001). In the defasciculating dose of vecuronium and IV lidocaine groups, the incidence of myalgia was 22 (50%) and 10(22.7%), respectively. The study's findings demonstrated that on day one, post-operative myalgia (POM) was considerably less common in the lidocaine group than in the vecuronium group (p=0.005).*

Conclusion and recommendation: *pretreatment with vecuronium reduced the incidence and severity of succinylcholine-induced fasciculation in comparison with the lidocaine groupHowever, POM was markedly reduced in the lidocaine group compared to the vecuronium group. We recommend usinga defasciculating dose of vecuroniumas a pretreatment to reduce succinylcholine induced fasciculation and IV lidocaine for POM.*

Keywords: succinylcholine, fasciculation, myalgia, , vecuronium, lidocaine, adult surgical patients,

CHAPTER 1: INTRODUCTION

1.1. Background of the Study

A quaternary ammonium depolarizing muscle relaxant is succinylcholine. It causes the prejunctional membrane of the neuromuscular junction to depolarize for an extended period of time without repolarizing, initially causing fasciculation and then gradually causing muscle relaxation. Many medical professionals believe it's the greatest medication for creating the perfect intubating circumstances needed for surgical procedures, anticipating problematic airways, and facilitating rapid sequence induction and intubation. The drug's low cost, fast onset, brief duration of effect, and profound muscular relaxation without the need for reversal are just a few of its many benefits. Endotracheal intubation is frequently necessary for patients under general anesthesia. Although many relaxing agents can be used for this purpose; Succinylcholine is still the most popularly used agent in our setup (1-3).

Although succinylcholine is a relatively safe drug, its utility is constrained by well-known adverse effects. The most serious adverse effects of this medicine are fasciculation, postoperative myalgia, an increase in serum potassium level, rhabdomyolysis, an increase in intracranial pressure, intraocular pressure, and intragastric pressure..(4).

Succinylcholine injection caused widespread, uncoordinated contractions of muscle bundles and groups as its first apparent consequence. When consciousness is returned, strength of these contractions could cause a sensation of muscular stiffness. (3, 5).

Fasciculation during induction and post-operative myalgia could cause the patient more discomfort than the pain from the surgical site. Muscle bundles contract vigorously during fasciculation, but there is no chance of shortening and there is no synchronized activity between adjacent bundles. This could result in fiber damage or rupture, which causes pain(6).

The postoperative myalgia, which generally appear 24 to 48 hours after succinylcholine injection and mimic the muscular symptoms that typically follow vigorous exercise, are generalized aches and pains(7). Fasciculation and myalgia have a wide range of incidence and severity. According to studies, 41% to 92% of patients experience this succinylcholine-induced postoperative

myalgia (POM), and up to 95% of patients experience fasciculation. In 1952, Bourne and Collier were the first to report the syndrome of post-operative myalgia (8-10).

The harm to the skeletal muscle caused by the unsynchronized contracting of adjacent muscle fibers right before paralysis, which occurs more frequently following minor surgical operations in outpatients, has been hypothesized as the cause of the muscular soreness(11).

The precise processes of succinylcholine-induced myalgia are still unknown, as is the pathophysiology of fasciculation and myalgia. Sustained muscle contractions, according to some theories, increase the concentration of calcium ions in the cytoplasm of muscle cells and cause the phospholipid in cell membranes to degrade. This increases the release of free fatty acids and free radicals, which in turn leads to muscle damage(2).The first attempt to reduce the incidence and severity of muscle pain was pretreatment with Gallamine in 1954(3). Since then, a variety of protocols have been examined, including pretreatment with rocuronium, atracurium, lignocaine, calcium, ketorolac, diclofenac sodium, diazepam, magnesium sulphate, thiopentone sodium, d-tubocurare, and vecuronium, among others (2). The efficacy of each is variable.

Prejunctional nicotinic receptors are thought to be blocked by none depolarizing neuromuscular blockers, preventing fasciculations and lowering postoperative myalgia. It is usual practice to administer a short dosage of a non-depolarizing neuromuscular blocker prior to succinylcholine to reduce the frequency and severity of postoperative myalgia.(6).

Additionally, the injection of intravenous lidocaine pretreatment, which limited the rise in serum potassium and fall in serum calcium, can prevent succinylcholine-induced muscle fasciculation. Lignocaine's action was related to its ability to stabilize cell membranes, which likely impeded ionic exchange across the cell membrane (6).

Although several regimens or pretreatments have been explored to lessen the frequency or severity of fasciculation and myalgia with succinylcholine, the effectiveness of such techniques is contested. So, comparing intravenous lidocaine and defasciculation doses of vecuronium for prevention of fasciculation and post-operative myalgia, was the objective of this study try to achieve.

1.2 Statement of the Problem

Succinylcholine drug side effects continue to be a significant issue in clinical settings around the world because they are accompanied by symptoms like muscular fasciculation, myalgia, masseter muscle spasm, hyperkalemia, rhabdomyolysis, increase intracranial pressure, intraocular pressure, and intragastric pressure(4). Fasciculation and myalgia are common side effects of this drug. However, fasciculation immediately after induction of anesthesia and subsequent myalgia in postoperative period outnumber the rest(2).

The patient may experience more distress from fasciculations during induction and post-operative myalgia than from the pain associated with the surgical incision. (10). Moreover,Succinylcholine-induced fasciculation may results in increase in intragastric and intra-ocular pressure(13).

The occurrence varies, but young, ambulatory patients experience them more frequently (7). Up to 95% of individuals exhibit fasciculation, while 41% to 92% of patients have succinylcholine-induced postoperative myalgia (POM)(9, 14).

The potential side effects of this medication are also quite upsetting for the patients, particularly for daycare patients whose discharge from the hospital could be delayed by postoperative myalgia. However, little is known about the pathogenesis of myalgia brought on by succinylcholine(15). Since then, numerous different treatment strategies have been investigated to prevent or reduce potential side effects caused by succinylcholine, including pretreatment with rocuronium, atracurium, lignocaine, calcium, ketorolac, diclofenac sodium, diazepam, magnesium sulfate, thiopentone sodium, d-tubocurarine, vecuronium, etc.(2). The efficacy of each of these drug is variable. Because of this reason, there is no established treatment for this side effect. In clinical practice, the use of intravenous lidocaine and nondepolarizing muscle relaxants at defasciculation dosages resulted in varying degrees of success in reducing succinylcholine-induced muscular fasciculations and post-operative myalgia.

There was no discernible difference between the distribution of fasciculation intensity in the lidocaine and atracurium groups, according to Naghipour and Bilehjani in 2022(9).

Another study showed that lidocaine is effective as a pretreatment medication to reduce postoperative myalgia when succinylcholine is utilized(16).

Another study found that lidocaine is just as efficient as atracurium at reducing fasciculation severity and frequency after succinylcholine injection during anesthetic induction. When it comes to lowering the frequency and severity of myalgia, atracurium is less effective than lidocaine (17).

Even though these two procedure (defasciculation dose of vecuronium, and lidocaine) are used often in TASH clinical practice, no objective assessment has been carried out on comparison of their effectiveness to prevensuccinylcholine-induceded fasciculation and postoperative myalgia. So, the aim of this study is to compare intravenous lidocaine and defasciculation dose of vecuronium to reducing fasciculation and post-operative myalgia induced succynylcholineamong Adult Surgical Patient at Tikur Anbessa Specialized Hospital.

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1.3 Significance of Study

The standard of care for patients in the practice of anesthesia is to select the anesthetic technique that will have the fewest side effect and cost. It is critical to be aware of the efficient anesthetic preparation approaches in order to prevent succinylcholine induced muscle fasciculation and postoperative myalgia(9, 17, 18)

This study has provided a rational and evidence-based foundation for a clinical practice in anesthesia that aims to reduce the prevalence of fasciculation and postoperative myalgia.The result of this study will help anesthesia professional to have an important altenative drug to dicrease unwanted succinylcholine induce effects during surgery under general anesthesia. After it is finished, this study can be used as a resource by professionals, researchers, and decision-makers for interventions.

CHAPTER 2: LITRATURE REVIEW

uccinylcholine is the only neuromuscular blocker medication choice for quick sequence induction of anesthesia and appears to be a popular muscle relaxant for mobile anesthesia and brief surgical operations. It has numerous advantages, including being inexpensive, having a quick onset and brief duration of action, and causing profound muscle relaxation without the requirement for muscle relaxation reversal. Fasciculation, postoperative myalgia, and an increase in serum potassium are this medication's most frequent side effects(19). Unpleasant side effects of succinylcholine administration include fasciculations during induction and post-operative myalgia. (6). The incidence is variable and are more common in young, ambulatory patients (7).

In Singapore 1997 by Raman SK San prospective, randomized, double-blind study on 80 ASA I Patients aged 20 to 50 were divided into one of four groups. Group A received 0.05 mg/kg atracurium three minutes prior to receiving 1.5 mg/kg succinylcholine; Group L received 1.5 mg/kg lidocaine 30 seconds prior to receiving 1.5 mg/kg succinylcholine; and Group AL received both atracurium and lidocaine. Group C received a placebo pretreatment. At 24 and 48 hours, fasciculations and postoperative myalgia were noted. Fasciculation was less in the atracurium (40%) and atracurium-lidocaine (30%) groups compared to the lidocaine (85%) and control (100%) groups (p0.05). Day 1 and Day 2 postoperative myalgia was lowest in the atracurium-lidocaine group (5%, 0%) (P 0.05), followed by the atracurium (35%, 25%), lidocaine group (30%, 35%), and control group (75%, 65%). They discovered that the combined use of lidocaine and atracurium resulted in an even higher reduction of postoperative myalgia.(20).

In California 2002 by Spance, Dennis, a randomized, double blind To assess the impact of pretreatment methods on the incidence and severity of myalgia following succinylcholine administration, a study involving 74 patients, ASA physical status I or II, ages 18 to 65, was conducted. As a pre-treatment, either 0.03 mg/kg of rocuronium or 1.5 mg/kg of lidocaine were given. Myalgia was measured for 53 patients were included in the analysis. In contrast to just 9 (38%) of the 24 patients in the rocuronium group, 21 (72%) of the 29 patients in the lidocaine group had no myalgia after 48 hours (P = 0.023). The total incidence of myalgia was 28% (8/29) in the lidocaine group while it was 62% (15/24) in the rocuronium group. The proportion of patients who experienced fasciculations in the lidocaine group (23/29 [79%]) was substantially higher than that in the rocuronium group (7/24 [29%]). (P = .0003). They draw the conclusion

that lidocaine pretreatment considerably reduced the intensity of POM reported at 48 hours better than rocuronium, indicating that lidocaine may provide longer-lasting postoperative myalgia relief(21).

Study in Thailand 2002 by Amornyotin, Santawat et al. a prospective double blind, randomized trial on 135 patients were assigned to one of three groups. Normal saline and succinylcholine 1.5 mg/kg were given to Group PS as the control group; lidocaine 1.5 mg/kg and succinylcholine 1.5 mg/kg were given to Group LS; and normal saline and rocuronium 0.6 mg/kg were given to Group PR. The presence, and degree of fasciculation and 24hrs later, any myalgia experienced was assessed. Muscle fasciculation was not seen in Group PR patients, however it was more prevalent in Group LS patients than in Group PS patients, according to the data (p 0.001). At 24 hours, Group PS had a higher incidence of myalgia than Group LS and PR ($p< 0.05$). They came to the conclusion that lidocaine is effective as a pretreatment medication for reducing postoperative myalgia.(16).

In Iran 2009 by Mokaram, Khoshfetrat, was conducted on 160 patients ASA I or II physical status, 20–50 years old, was randomly allocated to group A or group B. Atracurium (0.05 mg/kg) was administered to group A patients 3 minutes before succinylcholine. Lidocaine (1.5 mg/kg) was administered to group B patients 30 seconds before succinylcholine. Both groups received succinylcholine 1.5 mg/kg and evaluated fasciculation and myalgia. In both groups, fasciculation occurred and was equally severe ($p>0.05$). There were less myalgia in group B ($p<0.05$). They came to the conclusion that lidocaine is more effective than atracurium at reducing the frequency and severity of myalgia and that it is just as effective at reducing fasciculation(19).

Another Study in Iran 2017 by Shabanian, Gholamreza was conducted on 59 adults with ASA I or II were randomly assigned to two groups: Patients in Group A (n = 29) received 0.2-0.5 mg/kg of atracurium followed by succinylcholine 1 mg/kg , while those in Group B (n = 29) received 0.2-0.5 mg/kg of methocarbamol followed by succinylcholine 1 mg/kg. In Group A, there were 2 (6.9%) patients with moderate fasciculation and 27 (93.1%) individuals with mild fasciculation. In Group B, there were 20 cases of mild fasciculation (68.9%), 5 cases of moderate fasciculation (17.2%), and 4 cases of severe fasciculation (13.9%). Statistics showed that there was a difference between the groups (P 0.05) (22).

Another study in Iran 2022 by Naghipour and BilehjaniStudy conducted on Patients in two equal groups of 45 divided into group A received 0.05mg/kg atracurium 3 minutes before induction of anesthesia and group B received 1.5mg/kg lidocaine 30 seconds before induction of anesthesia. Following succinylcholine at a dose of 1.5mg/kg. Scores were given for fasciculation presence and severity. The degree of fasciculation was zero for 51.1%, 24.2% for one, 15.6% for two, and 8.9% for three in the lidocaine group. Overall, 64.4% atracurium and 51.1% lidocaine were used to prevent fasciculation, while the corresponding ratios in the atracurium group were 17.8%, 11.1%, 6.7%, and 64.4%, respectively(9).

The other study that compared IV lidocaine with Rocuronium showed that On the first postoperative day, there were fewer cases of myalgia in the RL group than in the R group and L group. In comparison to the R group and RL group, the L group had a higher incidence of fasciculations(23).

In India 2008 by Abraham, V Kumar and Arti Raj was performed on 120 individuals with an ASA score of I or II who were between the ages of 20 and 40. They were split into two groups: Group R patients received 0.06 mg/kg of rocuronium, while Group V patients received 0.01 mg/kg of vecuronium intravenously. In Group V, there were 5 (8.3%) patients with moderate fasciculation and 26 (43.3%) patients with mild fasciculation. In Group R, 19 patients (31.7%) showed mild fasciculation while none had moderate fasciculation. Three (5%) patients in Group V experienced mild myalgia on the first post-operative day, but none of the patients experienced moderate or severe myalgia. In Group R, 6 (10%) patients experienced mild myalgia, but no patients had moderate or severe myalgia. On the first postoperative day, neither group had statistically significant myalgia ($p>0.01$)(24). Similar study also stated that Rocuronium is better in reducing succinylcholine induced fasciculation and POM when compared with vecuronium(25).

Study in India 2014 by Penday. Ak. Kumer was conducted on 20 patients, aged 18 to 50, with an ASA physical status of I or II, were divided into three groups of 40 each. Group L received 1.5 mg/kg of intravenous lidocaine as a pretreatment, Group C received controls, and Group D received 75 mg of intramuscular diclofenac. A standardized questionnaire was used to assess the severity and intensity of post-operative myalgia one hour, 24 hours, and 48 hours after surgery.

Their research demonstrates that succinylcholine-induced myalgia was considerably (P=0.016) reduced in frequency and severity when given intravenously (IV). In contrast to the control group, IM diclofenac did not show this decrease (26).

Another study in India 2021 by Senapati, Battini et al, and 125 patients were randomly divided into two groups for the study; 59 were given rocuronium, while 66 were given vecuronium. before 1.5 mg/kg of succinylcholine, either 0.06 mg/kg of rocuronium or 0.01 mg/kg of vecronium should be administered. There were no fasciculations in either the ROC group (74.58%) or the VEC group (51.52%). Mild fasciculation was present in 22.03% of the ROC group and 33.33% of the VEC group. Moderate fasciculation was seen in 3.39% and 15.15%, respectively, of the ROC and VEC groups. The fasciculation of the ROC group was discovered to be considerably lower (p=0.015) than that of the VEC group when comparing the two groups. Patients in the ROC group (91.53%, n=54) and the VEC group (65.15%, n=43) showed no myalgia symptoms on the first day. Only 1.8% of individuals in the VEC group had moderate myalgia, compared to 8.47% (n=5) in the ROC group and 31.82% (n=21) in the VEC group have mild myalgia. According to the study's conclusions, the ROC group had significantly less postoperative myalgia on day one than the VEC group did. Day two saw a noticeably decreased incidence of POM in both groups. Fisher's exact test (p=1.000) revealed no difference between the two groups in terms of statistical significance. On day three, none of the patients experienced myalgia(27).

Another study in India 2020 by Halvadia and Patel conducted on total of 160 patients of ASA I and II, Age between 18 & 50 years, divided into two groups with 80 patients in each group. Group a patients were administered with IV lidocaine and Group B patients were taken as control. Severity and incidence of fasciculation and myalgia was assessed by standardize questionnaire a significant difference ($p< 0.016$) fasciculation is observed between a group.Post-operative myalgia was assessed three time between the groups. within the two therapy groups, there is a considerable decline in discomfort over time. While none of the groups experience a significant decrease in POM intensity from 1 hour to 24 hours ($p>0.016$), all of the treatment groups have a significant decrease from 24 hours to 48 hours ($P<0.016$). They came to the conclusion that the best way to stop succinylcholine myalgia is with lidocaine pretreatment(8).

In Bangladesh 2019 by Hossian, Sajowal et al At the National Institute of ENT in Dhaka, Eighty adult patients with ASA I and II were randomized into two equal groups and given either lignocaine or normal saline at random. Patients were given isotonic saline 0.9% for the normal saline group and intravenous lignocaine 1.5 mg/kg for the lignocaine group. A blinded observer evaluated the prevalence and intensity of myalgia 24 hours after surgery. When compared to the normal saline group, the incidence and severity of succinylcholine-induced myalgia were generally considerably lower in the lignocaine group (P 0.05). They came to the conclusion that intravenous lignocaine pretreatment was successful in preventing postoperative succinylcholine-induced myalgia(2). As we have seen from this literature,there are various conflicting results between non-depolarizing muscle relaxant and pretreatment with lidocaine regarding the effectiveness on preventing succinylcholine induced muscle fasciculations and post-operative myalgia.Most studies show that,lidocaine is more effective than non-depolarizing muscle relaxant in preventing post- operative myalgia while other concluded that lidocaine is less than or as effective as non-depolarizing muscle relaxant in preventing fasciculation.

2.1 Hypothesis

H1o: There is no difference between the defasciculation dose of vecuronium and IV lidocaine pretreatment on the incidence and severity of succinylcholine induced fasciculation

H1a: There is difference between defasciculation dose of vecuronium and IV lidocaine pretreatment on the incidence and severity of succinylcholine induced fasciculation.

H2o: There is no difference between the defasciculation dose of vecuronium and IV lidocaine pretreatment on the incidence and severity of succinylcholine induced postoperative myalgia.

H2a: There is difference between defasciculation dose of vecuronium and IV lidocaine pretreatment on the incidence and severity of succinylcholine induced postoperative myalgia.

CHAPTER 3: OBJECTIVES

3.1 General objective

To compare Defasciculation Dose of Vecuronium and Intravenous Lidocaine for Preventing Succinylcholine Induced Muscle Fasciculation and Post-Operative Myalgia among Adult Surgical Patient at Tikur Anbessa Specialized Hospital, from January 1 to March 30, 2023.

3.2.Specific objectives

To determine the incidence of fasciculation between defasciculation dose of vecuronium and IV lidocaine.

To compare severity of fasciculation between defasciculation dose of vecuronium and IV lidocaine.

To determine the incidence of postoperative myalgia between defasciculation dose of vecuronium and IV lidocaine

To compare severity of postoperative myalgia between defasciculation dose of vecuronium and IV lidocaine.

4. METHODS AND MATERIALS

4.1. Studyarea

This study was carried out at Tikur Anbessa Specialized Hospital, the biggest multispecialty teaching hospital in Addis Abeba, Ethiopia. It was founded in 1972 and was transferred to a school by the FMOH in 1978, at which point it became a university teaching hospital. It is a facility where the entire country can receive specialist clinical services that are not provided by other public or private facilities. It has roughly 800 beds, about 17 operating rooms, 7,000–9,000 patients undergo surgery there annually, including emergency surgery, and it employs more than 900 medical personnel.

4.2. Study design and Period

Prospective cohort study was conducted at Tikur Anbessa Specialized Hospital from January 1 to March 30, 2023.

4.3 population

4.3.1 Source of population

All adult elective surgical patients who underwent surgery at Tikur Anbessa Specialized Hospital in Addis Abeba, Ethiopia, under general anesthesia with endotracheal intubation.

4.3.2 Study population

All adult elective surgical patients who underwent surgery while under succinylcholine anesthesia at Tikur Anbessa Hospital in Addis Abeba, Ethiopia, during the study period.

4.4. Study Variable

4.4.1. Dependent Variable

Succinylcholine induced fasciculation

Succinylcholine induced post-operative myalgia.

Succinylcholine induced Severity of fasciculation and post-operative myalgia

4.4.2. Independent Variable

Sociodemographic (age, sex, BMI)

ASA physical status

IV induction agents

Defasciculating dose of vecuronium

Intravenous lidocaine as a pretreatment

4.5. Eligibility criteria

4.5.1: Inclusion criteria

a. patient age between 18 to 60 years

b. ASA status I and II

c. BMI below 30kg/m2(22)

4.5.2. Exclusion criteria:

a. Pregnant mother

b. Suspected difficult tracheal intubation,

c. Trauma, malignant hyperthermia and burn patients,

d. patient with pre-existing musculoskeletal disorders.

e. patient who are hypersensitive to any of the drug in the study

F. Patient refusal

G. Patient with increase ICP and IOP

H. patient with hyperkalemia

I. All patients contraindicated with succinylcholine

J. treatment with any drug having muscle relaxant properties such as calcium channel blocker, magnesium sulfate or taking NSAID

K. patient with neurologic injury or spinal injury

4.6. Sampling technique and sample size determination

4.6.1. Sample size determination

Using the double proportion formula, the sample size for the study was determined for the comparison of two proportions under the following assumptions: significance level 5% (=0.05), and study power (1-) of 80%. In one study conducted in India in 2021 by Senapati, Battini et al., 48% of patients in the vecuronium group experienced fasciculation, and 20% of patients in the lidocaine group in Bangladesh in 2019 by Hossian, Sajowal et al(2, 27) taking this intoconsideration, the calculation of sample size has been.

$$n = (Z_{\alpha/2}+Z_{\beta})^2 * (p_1(1-p_1)+p_2(1-p_2)) / (p_1-p_2)^2$$

.

Where:

N= sample size in each group

α = significance level(1.96)

1-β= power of study at 80% (0.84)

P1= incidence of fasciculation in de- fasciculation dose of vecuronium

P2= incidence in intravenous lidocaine.

n=(1.96+0.84)2*(0.48x0.52+0.2x0.8)/(0.48-0.2)2= 40 in each group. The sample size in each group was 44, and 88 adult elective surgery patients in total were included in this study after adding 10% of the total sample size as a contingency.

4.6.2. Sampling technique

Using a systematic random sample technique with a skip interval from the daily operations in the OR in those patients who had utilized succinylcholine, which was employed as a sampling frame, study participants were chosen.

Eight patients per day, or 160 patients per month, underwent surgery with succinylcholine in TASH during a situational study that was conducted for one month. The formula K=N/n, where n is the total sample size, N is the population during the study period, and K is equal to 320/88, was used to find the sampling interval K. From the list of the daily operating schedule participants, the first study participant was chosen via lottery. Then, during the study period, every fourth case from the operating schedule was included in the study.

4.7. Data collection procedure

The systematic rondom sampling technique was used to divide study participants into two groups as soon as the patients arrive operating room. All study participents underwent standard pre and inrtaoperative monitoring of general anesthesia after obtaining their consent and either 0.01mg/kg defasciculation dose of vecuronium or 1.5mg/kg of IV lidocaine was administered 3 minute and 30sec before suxamethonium, respectively.Socio-demographic information, the patient's ASA class, the incidence and severity of fasciculation and post-operative myalgia were included in our questioner. As soon as suxamethonium was administered, two BSc anesthetists who had received training in how to grade fasciculation and myalgia saw the fasciculation and 24 hours later asked the patients about their postoperative myalgia. There was contineous supervision and follow upby principal investigator.

A structured questioner that has been developed in English and has already undergone testing was utilized to collect the data through observation and interview.

4.8. Operational definition

ASA status: The American Society of Anesthesiologists has approved surgical risk classification.

ASA I: a healthy patient with no physical or mental health issues.

ASA II: Managed medical conditions without functional limitations and just a little systemic impact.

Defasciculation dose of vecuronium: dosage of 0.01 mg/kg of vecuronium three minutes before succinylcholin administratione(11).

Intravenous Lidocaine: administration of 1.5mg/kg IV as a pretreatment 30 secondsbefore administration of succinylcholine.(9).

Fasciculation: brief, spontaneous contraction or twitch in a muscle.(8)

Grade 0 = no visible fasciculation

Grade 1(mild) = Very fine fingertip or facial muscle movements

Grade 2(moderate) = Minimal fasciculations on trunk and extremities

Grade 3(severe) = Vigorous fasciculations on trunk and extremities.

POM: a term for the widespread aches and pains that frequently persist for up to 24 hours after succinylcholine injection(2).

Grade0(Nil): - No muscle pain or stiffness

Grade 1(Mild): -muscle pain or muscle stiffness at one site but not causing disability or limiting activities

Grade 2(Moderate): -Muscle pain or stiffness noticed spontaneously by the patient, possibly requiring analgesic therapy

Grade 3(Severe): -Generalized, severe or incapacitating discomfort

4.9. Data quality management

To ensure the quality of the data, pretest on 5% of sample size was done on those who underwent elective surgery under general anesthesia using suxamethonium. Two BSc anesthetist were selected to collect the data and one day training was given on the data collection tool, techniques

of data collection and how to approach study participants. Close supervision and daily information exchange including by telephone was used as a means to correct problems during the course of data collection.

4.10. Data processing and analyses procedure

The data was entered into epidata version 4.6 and transported to SPSS version 25 statistics software for analysis. The data was tested for normality using histogram and shapiro-wilk normality test.

Continues data was presented as mean±SD, and categorical data was presented as frequency (percentages).Continues data was analyzed byindependent t-test and categorical data, was analyzed by chi-square.Statistical significance will be considered at $p<0.05$.

4.11. Ethical consideration

Before the study could begin, the ethics commission gave its approval. A formal letter of support was addressed to the hospital, and the appropriate authority was asked for consent to collect data. Each participant provided both verbal and written informed consent after being told of the study's importance and goal. By staying away from IDs and using code to identify patients, confidentiality was preserved throughout the whole trial. Anyone who wishes to discontinue their participation in the study at any point is notified and given complete freedom to do so.

4.12. Dissemination of result

When this study is finished, academics, experts, and policymakers can use it as a resource. The finished manuscript will be delivered to the College of Health Sciences, Department of Anaesthesia, to reach this body. TASH, the Addis Abeba University student research office, the Ethiopian Association of Anaesthetists, and the Ethiopian Ministry of Health will also receive copies of this information. The outcome will also be shared by publishing it in scholarly local or international journals and presenting it at associated workshops and seminars.

CHAPTER 5: RESULT

5.1 sociodemographic and perioperative characteristics of the patients

A sample of 88 patients between the ages of 18 and 60, with a mean age of 37, were included in this study. forty one (41) men and forty seven (47) women. Twenty-six (26) patients had an ASA I status, while sixty-two (62) patients had an ASA II condition. In addition, 69 patients had a BMI between 18.5-24.9 kg/m2, seven (7) patients had a BMI between 25-29.9 kg/m2, and twelve (12) patients had a BMI of less than 18.5 kg/m2.

During the study period, patients were analyzed based on whether they received defasciculation dose of Vecuronium or intravenous lidocaine as a pretreatment for prevention of succinylcholine induced fasciculation and myalgia. They randomized into two groups with 44 patients in each group. Age, gender, BMI, and ASA status were among the demographic patient characteristics that were recorded, and they were equivalent for the two groups. (Table 1). With regard to induction agents and analgesic drug used during surgery, it was found that almost all patients received propofol while majority of them received fentanyl, respectively in both groups.

Table 1: shows the sociodemographic information and preoperative details of patients who underwent elective surgery in Addis Abeba's Tikur Anbessa Specialized Hospital in 2023.

Variable		**Vecuronium**	**Lidocaine**	**p-value**
Age		37.40±13.46	37.42±13.78	0.722
BMI		20.65±2.14	20.67±2.23	0.433
Sex	Male n (%)	21(23.86)	20(22.72)	0.388
	Female n (%)	23(26.1)	24(27.27)	
ASA status N (%)	ASA 1	12(13.6)	14(15.9)	0.172
	ASA 2	32(36.3)	30(34.9)	
Induction agents N (%)	Propofol	43(48.86)	44(50)	
	Thiopenal	1(1.13)	0	
Analgesia during induction N (%)	Fentanyl	38(43.18)	35(39.77)	0.395
	Morphine	6(6.81)	9(10.22)	

5.2 Comparisons of the incidence and severity of fasciculation.

The incidence of fasciculation in the defasciculating dose of vecuronium group was 11 (25%) while in the intravenous lidocaine group, it was found to be 32 (72%). There was no fasciculation in 33(75%) of patient in the vecuronium group, while the remainder 9(20.45%) had mild fasciculation and only 2(4.5%) had moderate fasciculation but there was no severe fasciculation. In the intravenous Lidocaine group, 12 patients (27.27%) had no fasciculations, while 17 patients (38.6%), 13 patients (29.5%), and 2 patients (4.5%), respectively, had mild, moderate, and severe fasciculations. (Table 2).

When compared to intravenous lidocaine pretreatment, the severity of fasciculation was substantially less severe with a defasciculating dose of vecuronium (p=0.0001). Therefore, compared to intravenous Lidocaine, the defasciculation dose of vecuronium pretreatment considerably reduces the occurrence of fasciculation.

Table 2: shows the frequency and severity of succinylcholine-induced fasciculation in patients who had elective surgery under general anesthesia at Tikur Anbessa Specialized Hospital in Addis Abeba in 2023

Parameter		Vecuronium group (n=44)	Lidocaine group (n=44)	p-value
Fasciculation	Incidence	11(25%)	32(72%)	0.0001
	Nil	33(75%)	12(27.27%)	
	Mild	9(20.45%)	17(38.6%)	0.05
	Moderate	2(4.5%)	13(29.50%)	0.002
	Severe	0(0%)	2(4.5%)	0.247

Notes: The chi-square test was used to analyze the data and find differences in the occurrence and severity of fasciculation. Nil = No fasciculation.

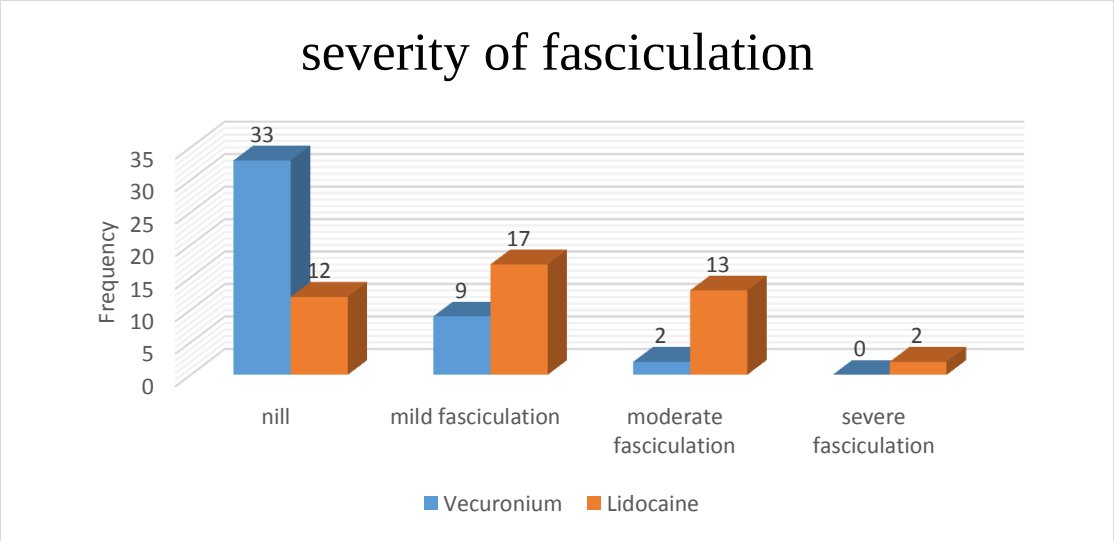

Figure 1: Succinylcholine-induced fasciculation was distributed in patients at Tikur Anbessa Specialized Hospital in Addis Abeba in 2023 who underwent elective surgery while under general anesthesia.

5.3 Comparisons of the incidence and severity of Myalgia

Out of 44 participants in each group, 22 (50%) had postoperative myalgia. In the "Vecuronium" group, 15 (34.1%) had mild postoperative myalgia, and 7 (15.9%) had moderate but no severe post-operative myalgia. In the "Lidocaine" group, 10 (22.7%) had mild postoperative myalgia, but there were neither moderate nor severe postoperative myalgia.The presence of myalgia (p=0.007) and the severity of myalgia (p=0.006) varied significantly between the groups.

Table 3: Succinylcholine-induced myalgia frequency and intensity in patients undergoing elective surgery under general anesthesia at TASH, Addis Abeba, 2023

Para meter		Vecuronium group (n=44)	Lidocaine group (n=44)	p-value
Myalgia	Incidence	22(50%)	10(22.7%)	0.007
	Nil	22(50%)	34(77.27%)	
	Mild	15(34.1%)	10(22.7%)	0.172
	Moderate	7(15.9%)	0	0.006
	Severe	0	0	

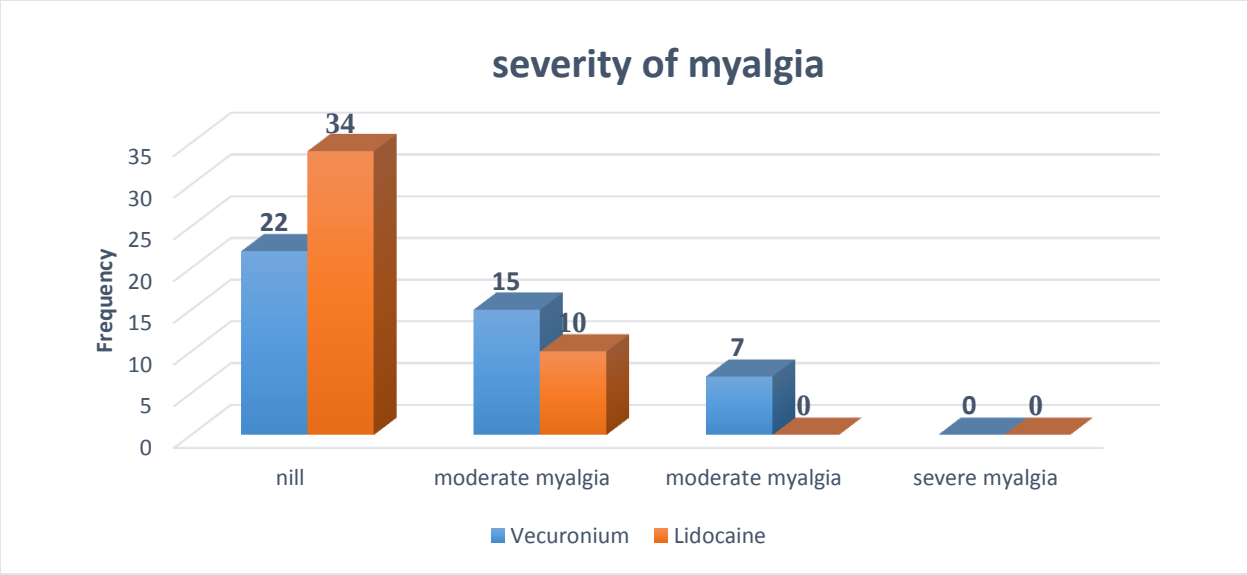

Figure 2 shows the distribution of succinylcholine-induced myalgia in patients who underwent elective surgery under general anesthesia in Addis Abeba in 2023.

Chapter 6: Discussion, Strength and limitation

6.1 Discussion

According to this study, the incidence of post-succinylcholine fasciculation during induction was 25% and 72%, respectively, in the vecuronium and lidocaine groups. Comparing the vecuronium group to the lidocaine group, it demonstrates a statistically significant reduction in intraoperative fasciculation (p=0.0001). The result of this study is in line with the study done in USA that showed the incidence of post succinylcholine fasciculation in vecuronium group was 25%(11). Another study conducted in Thailand revealed that 71% of the group receiving lidocaine experienced succinylcholine-induced fasciculation(18) . Similar to this, a study conducted in the USA revealed that considerably more participants in the lidocaine group (79%) than the rocuronium group (29%) suffered fasciculations (P =.0003).)(21)

The current study, mild and moderate fasciculation was seen in 38.6% and 29.5% of lidocaine groups respectively. In accordance with this study, the study done in Korea showed that, the incidence of mild and moderate fasciculation in lidocaine group was 40% and 35% respectively(23).

In contrast to our study that showed the incidence of mild(20.45%) and moderate(4.5%) facsciculation in vecuronium group, the study done in india showed that the incidence of mild and moderate fasciculation that was seen in vecuronium group was 43.3% and 8.3%, respectively. This deference may be duo to larger sample size and shorter interval(60seconds) between vecuronium and succinylecholine administration in their study(24). The current study used 3 minutes interval between vecuronium and succinylecholine administration.

A recent study done in India that assessed the effect of pre-treatment with rocuronium and vecuronium on post succinylcholine fasciculations showed that the incidence of mild and moderate fasciculation was 50% and 14% in vecuronium group which is higher compared to our study result. Even though the sample size is comparable ,it is methodologically different from our study, which was randomized, double-blind study(25). Other study done in India showed that, mild and moderate fasciculation was observed in 33.33% and 15.15% respectively, of participant in vecuronium group.

This result is higher when compared to our study result,which may be attributed to the shorter interval (60s) between vecuronium and succinylcholine administration they used and the method they used, which was randomized double-blind study(27).

This study also showed thatthe incidence of post-succinylcholine myalgia was 50% in vecuronium group and it is in line with the study done in United Kingdom that showed 42% of participants in vecuronium group ware found to have myalgia(5)

This study also showed thatthe incidence of post-succinylcholine myalgia was22.7% in lidocaine group, which is in line with the study done in Bangladish that showed the incidence of myalgia in lidocaine group to be 20% at 24hr post-operative(2). Similarly, the study done in Singapore also showed that myalgia was observed in 30% of participants in lidocaine group(20). But the study done in USA showed that there was no significance differance between lidocaine and rocuronium groups in severity of postoperative myalgia at 24hours (P > .05.)(21). The result of their study might be compromised by the smaller sample size when compared to our study.

6.2. Strength

Having no incomplete data with missing values and homogeneity of study participants between the groups were the strengths of the current study.

6.3 Limitation

Being a singlecenter study with a limited sample size.

The other limitation is that we did not assess other side effects of succinylcholine like arrhythmia and apnea.

Lack of randomization, lack of blinding,

Chapter 7: Conclusion and recommendation

7.1. Conclusion

In contrast to the lidocaine group, our study found that the incidence and severity of fasciculations were much lower in the vecuronium group. On the other hand, the incidence and severity of POM in the lidocaine group were noticeably lower than in the vecuronium group on day one.

7.2 Recommendation

Our research suggests that anesthesia professionals employ a defaciculating dose of vecuronium to lessen succinylcholine-induced fasciculation and IV lidocaine for myalgia following surgery.. And also we recommend the researcher to evaluate the combination of lidocaine and vecuronium in three groups with large sample size including the patients with risk of developing post operative myalgia.

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ANNEXES

Annex I: Assurance of principal investigator

I the undersigned agree to accept responsibility for the scientific ethical and technical Conduct of the research project and for provision of required progress reports as per terms and conditions of the Research Publications Office in effect at the time of Grant is forwarded as the result of this Application.

Name of the principal investigator: **Ayantu Ibrahim**

Date: November 2022 Signature _____

Name of the advisor: **Mr Zewetir Ashebir (Lecturer at AAU)**

Date: November 2022. Signature _____

Annex II. Information and consent form

Hello, my name is _____ from Addis Ababa University, college of health science, Post graduate studies. I will be going to conduct study on reduction of fasciculation and Post-operative myalgia which resulted by succinylcholine. So, you are kindly requested to be included in this study, which will have importance in reduction of postoperative myalgia & increase patient satisfaction. The interview will take about 5 minutes, your information will never have passed from individual to individual or from institution to institution without your agreement. Your participation is voluntarily & you have a right to not participate fully or partially. If you agree to be part of this study, I will start my question by asking general identification points. Only honest answer would contribute for improvement of our health service. The study has approval from AAU. May I continue? YES NO

If you say "yes" for the above question here there is a consent form that you will going to sign to be part of the study. I have been briefly informed about the study and I clearly understood the objective of the study, since it does not affect my personal life, I do not need any remedy. Consequently, I here to approve my consent to take part in the study as interview with my signature. Signature_____ Date_____

ሰላም፣ስመ_____ ይባላለሁኝ የአአዩ ጠ/ሳ/ኮ ድህረ ምረቃ ፕሮግራም ተማሪ ስሆን፣ አንድ አንድ የአኒስተዝያ መዳኒቶች የሚያመጡት የጡንቻ መርገብገብ እና ከሆፕራስሆን በኋላ የጡንቻ ህመም ለመቀነስ ጥናት ላይ ስሆን የእርሶ በበጎፍ ቃደኝነት መሳተፍ አስፈላጊ መሆኑን እየገለፅኩ ጥያቀው ከ5 ደቂቃ በላይ አንደ ማይወስድ ላረጋግጥሎት እወዳለው፤ በተጨማርም የእርሶ ማረጃ ከሰው ወደ ሰው ወይም ከተጀም ወደ ተጀም ያለ እርሶ ፍቃድ እንደማይተላለፍ ቃል እየገባው፣ የእርሶ ተሳታፍነት በሙሉ ፍቃደኝነቶ ብቻ የምረጋገጥ መሆኑን እያረጋግጥሎት፤ በመጨረሻም የጥናቱ ተሳታፊ መሆን ከፈለጉ ከዚ በታች የተገለፀውን የስምምነት ወረቀት አምብቦ እንድፈርሙልኝ በትህትና እጠቃለው፤ የጥናቱ ይዘት በትክክል የተገለፀልኝ ስሆን አላማውንም ተረድቻለው፣ በመሆኑም ያለምንም ማመንታት የጥናቱ አካል መሆነን በፍርማ የአረጋግጣለው፤

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Annex III: Data collection tool in English Version

Instruction: For each of the questions, please circle the number of alternative(s) that fit theresponse, fill the blank space provided or provide appropriate response accordingly.Code…….

Part: I Question on socio-demographic characteristics:

1.1	Patient MRN	_____
1.2	Age (year)	_____year
1.3	Sex	A. Male B. Female
1.4	Weight	_____kg
1.5	Height	_____cm
1.6	BMI	_____kg/m2

Part II: Question on preoperative evaluation and induction drug

2.1	ASA	A. I B. II
2.2	Induction agent use	A. Propofol _____mg/kg B. Thiopental _____mg/kg C. Ketamine _____mg/kg
2.3	Analgesia during induction	A. Tramadol _____ mg/kg B. Morphine _____ mg/kg C. Fentanil _____mg/kg D. Pethidine _____ mg/kg E. Other _____ mg/kg

Part III: Incidence and severity of fasciculation

3.1	No fasciculation	A. Yes B. No
3.2	Mild fasciculation (involves eyes, face, neck, fingers without movement of limbs)	A. Yes B. No
3.3	Moderate fasciculation (Fasciculation of greater intensity at more than two sites or movement of limbs)	A. Yes B. No
3.4	Severe fasciculation (Vigorous sustained and widespread Fasciculation)	A. Yes B. No

Part IV: patients compliant post-operative muscle pain

4.1	Do you have any pains and aches or stiffness in your muscles other than the operation site?	A. Yes B. No
4.2	If you answer yes for Que.4.1 limit to one site of your body?	A. Yes B. No
4.3	You fill more than one site of your body or you take any medication for the pain?	A. Yes B. No
4.5	Does this pain restrict your normal activity? A. Can you get out of bed? B. Can you able to turn your head? C. Can you cough without distress or pain?	A. Yes B. No

Part V. Incidence and severity of myalgia.

4.1	Nil myalgia	A. Yes B. No
4.2	Mild myalgia (muscle pain or muscle stiffness at one site but not causing disability or limiting activities).	A. Yes B. No
4.3	Moderate myalgia (muscle pain or muscle stiffness at more than one site but not causing disability or limiting activities).	A. Yes B. NO
4.4	Severe myalgia (muscle pain or stiffness at one or more site and causing disabilities or limiting activity)	A. Yes B. No

Name of data collector _____ Status/profession _____

Signature_____ Thank you!!