Can Lidocaine Reduce Succinylcholine Induced Post-operative Myalgia?

SOMCHAI AMORNYOTIN, M.D.*,
PRANEE RACHATAMUKAYANANT, M.D.*,
HATAIRAT PIPATNARAPHONG, M.D.*
UBOLRAT SANTAWAT, M.D.*,
PASSAPORN NILSUWANKOSIT, M.D.*,

Abstract

This study was undertaken to determine the effect of lidocaine pretreatment on reduction of succinylcholine-induced myalgia in patients undergoing general anesthesia for gynecological surgery. One hundred and thirty-five patients were assigned to one of three groups in a prospective, double blind, randomized manner. Group PS, the control group, received normal saline and succinylcholine 1.5 $mg.kg^{-1}$; Group LS, lidocaine 1.5 $mg.kg^{-1}$ and succinylcholine 1.5 $mg.kg^{-1}$; Group PR, normal saline and rocuronium 0.6 $mg.kg^{-1}$. Morphine 0.1 $mg.kg^{-1}$ iv was given for premedication and all patients were monitored with a noninvasive blood pressure monitor, ECG and pulse oximetry. Anesthesia was induced with 5 $mg.kg^{-1}$ thiopental iv. followed by succinylcholine (Group PS, LS) or rocuronium (Group PR) for tracheal intubation. Following administration of these agents, the presence, and degree of fasciculation were assessed visually on a four point scale by one investigator who was blinded to the drug administered. The blood pressure and heart rate of each patient were monitored on nine occasions. Twenty-four hours later, any myalgia experienced was assessed according to a structured questionaire and graded by a four point scale by one investigator blinded to the intraoperative management. The results indicate that muscle fasciculation was not found in Group PR while the patients in Group LS had a lower incidence of muscle fasciculation than those in Group PS ($p<0.001$). At 24 h, the incidence of myalgia was higher in Group PS than in Group LS and PR ($p<0.05$). A correlation was not found between the incidence of myalgia and the occurrence of muscle fasciculation. The changes in systolic and diastolic blood pressure and heart rate were not significant among the three groups. In conclusion, where succinylcholine is used, lidocaine is proven to be the useful pretreatment agent for the reduction of postoperative myalgia.

Key word : Lidocaine, Succinylcholine, Postoperative Myalgia

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SANTAWAT U, RACHATAMUKAYANANT P,
NILSUWANKOSIT P, PIPATNARAPHONG H
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* Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand.

Succinylcholine is considered by many to be the best drug for providing ideal intubation conditions and rapid sequence induction. However, in addition to a number of infrequent, but well-known, untoward effects, its usefulness is limited by the frequent occurrence of postoperative myalgia. This is often listed as a minor adverse effect but it may be a very distressing experience for the paitent.

The reported incidence of succinylcholine-induced myalgia ranges from 1.5 to 89 per cent[1,2]. The most commonly quoted figure is around 50 per cent. The duration of the discomfort is highly variable. It usually lasts for 2 or 3 days but occasionally persists for as long as a week. It usually appears on the first day after surgery, is most commonly described as the pain one might suffer after an unaccustomed degree of physical exercise, and is usually located in the neck, shoulder and upper abdominal muscles. Although self-limiting, it is generally agreed that iatrogenic postoperative myalgia is unacceptable in modern anesthetic practice[3].

The primary objective of this study was to study the efficacy of lidocaine for reducing succinylcholine induced postoperative myalgia in Thai women who had undergone gynecological operations. The secondary objective aimed at comparison of hemodynamic response with and without lidocaine pretreatment, and incidence of postoperative myalgia using rocuronium for tracheal intubation.

MATERIAL AND METHOD

We studied 135 ASA physical status I and II patients, aged 15-70 yr, after obtaining Institutional Review Board Ethics Committee approval and written informed consent. All patients were scheduled for elective gynecological surgery lasting about 1-3 hours with tracheal intubation being required.

Each patient was assigned to one of three groups in a prospective, double blind, randomized manner. Group PS, the control group, received normal saline and succinylcholine 1.5 $mg.kg^{-1}$; Group LS, lidocaine 1.5 $mg.kg^{-1}$ and succinylcholine 1.5 $mg.kg^{-1}$; Group PR, normal saline and rocuronium 0.6 $mg.kg^{-1}$. Both pretreatment medication and intubation agents were administered in a double-blind fashion from syringes containing solutions diluted to the same volume.

All patients received morphine 0.1 $mg.kg^{-1}$ iv for premedication and were monitored with a noninvasive blood pressure, ECG and pulse oximetry monitors. Anesthesia was induced with 5 $mg.kg^{-1}$ thiopental iv followed by succinylcholine (Group PS, LS) or rocuronium (Group PR) for intubation. Anesthesia was maintained with nitrous oxide 66 per cent in oxygen, halothane 0.5-1 per cent, pancuronium with incremental doses of morphine given as required. Noninvasive blood pressure, heart rate, ECG and pulse oximetry were recorded at base line, after premedication, induction, intubation and every 2 min until 10 min after intubation.

Following administration of the intubation agents, the presence, and degree of fasciculation were assessed visually on a four point-scale by one investigator who was blinded to the drugs used : 0 no visible fasciculation; 1 (mild) very fine finger tip or facial muscle movement; 2 (moderate) minimal fasciculation on the trunk and extremities; 3 (severe) vigorous fasciculation on the trunk and extremities.

Twenty-four hours later, one of the authors, blinded to the intraoperative management, assessed the myalgia according to a structured questionaire and graded it by a four point scale described by White[4] : 0 (nil) no pain ; 1 (slight) pain at one site but not causing disability; 2 (moderate) pain at more than one site but not causing disability; 3 (severe) pain at more than one site and causing disability.

Statistical analysis

Continuous data are presented as mean ± standard deviation and categorical variables are presented as counts and percentages. Comparisons of the categorical data among the three groups were performed using a chi-square test. One-way analysis of variance (ANOVA) was employed to compare continuous variables among the three groups.

All statistical analysis were performed using SPSS/PC Version 10.0. A 2-sided p-value of less than 0.05 was considered statistically significant.

RESULTS

One hundred and thirty-five Thai women were studied. The basic characteristics of the patients are described in Table 1.

The incidence of muscle fasciculations are shown in Table 2. There was no muscle fasciculation in Group PR. The patient in Group LS had a lower incidence of muscle fasciculation than those in Group PS ($p<0.001$). However, the severity of muscle fasciculation was mild to moderate in both groups (Group PS, LS).

At 24 h, 60 per cent of the patients in Group PS had myalgia compared with 48.9 per cent in Group

Table 1. Demographic data.

	PS	LS	PR
Age (yr)	40.8 ± 11.8	443.5 ± 10.9	39.9 ± 11.0
Body weight (kg)	55.0 ± 9.0	51.6 ± 6.7	55.9 ± 9.3
Height (cm)	155.4 ± 5.1	153.7 ± 4.6	157.0 ± 5.6
ASA (%) : I	75.6	73.3	75.6
II	24.4	26.7	24.4

Table 2. The incidence of muscle fasciculation (per cent) before endotracheal intubation was performed.

	PS	LS	PR	p-value
No	4.4	28.9	100	<0.001*
Mild	48.9	51.1	-	
Moderate	37.8	17.8	-	
Severe	8.9	2.2	-	

* combined moderate and severe

Table 3. Per cent of verbal four-point rating scale for postoperative myalgia at 24 h of three groups.

	PS	LS	PR	p-value
No	40.0	51.1	68.9	<0.043*
Mild	44.4	35.6	15.6	
Moderate	8.9	8.9	13.3	
Severe	6.7	4.4	2.2	

* combined moderate and severe

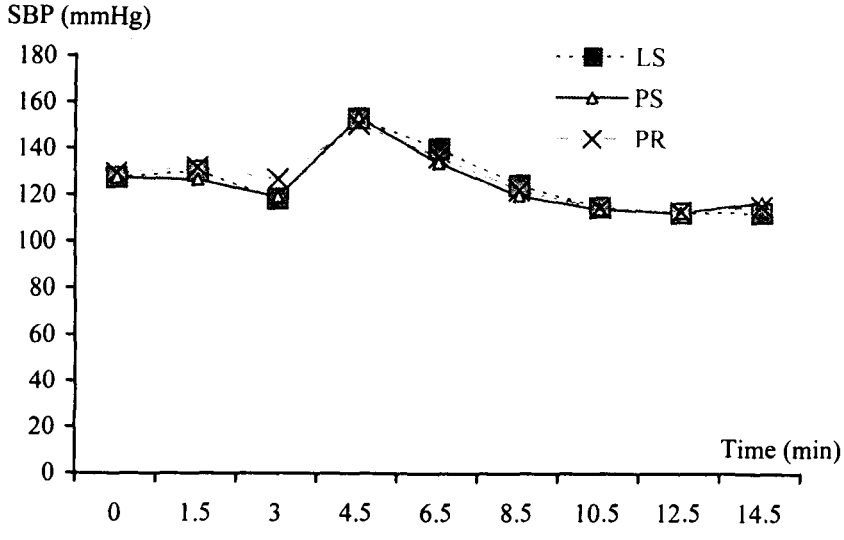

Fig. 1. The changes in systolic blood pressure.

LS and 31.1 per cent in Group PR (Table 3). The difference between the control group (Group PS) and the other two groups was statistically significant ($p < 0.05$). The incidence of myalgia was lower in Group PR than in Group PS and LS. No definite correlation was found between the incidence of myalgia and the occurence of muscle fasciculation.

The changes in systolic and diastolic blood pressure and heart rate were not different among the three groups (Fig. 1-3). No separate adverse effects were noted in this study.

DISCUSSION

Succinylcholine-induced muscle pain is a common problem in surgical patients. It has recently been reported to occur in around 60 per cent. The reasons for this are not completely known but may be due to more vigorous use of muscles in early

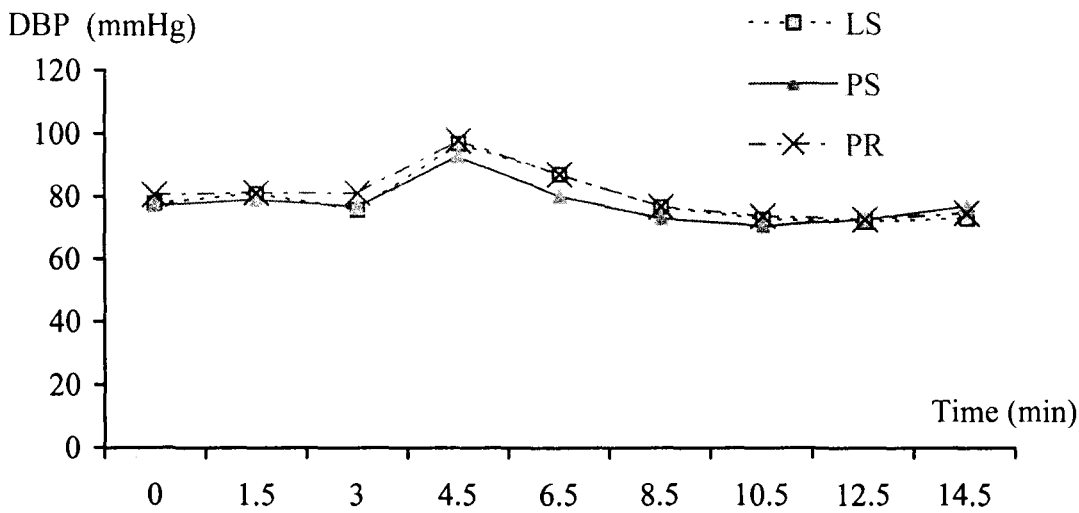

Fig. 2. The changes in diastolic blood pressure.

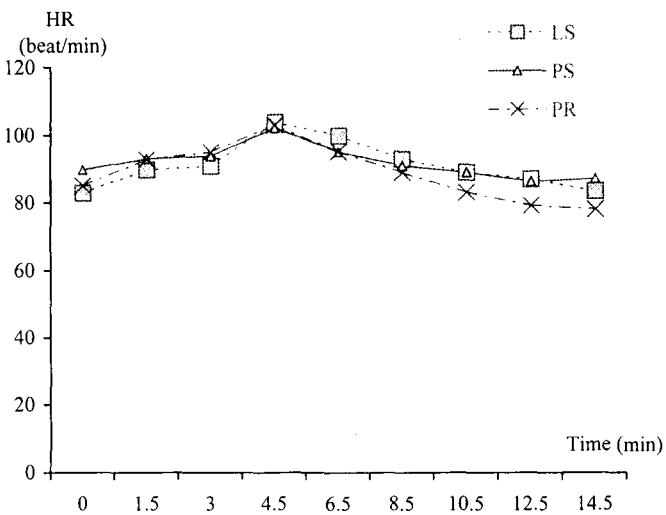

Fig. 3. The changes in heart rate.

ambulation, or use of lower potency analgesics. Whatever the reasons, it is important to determine the most effective way to decrease these muscle pains.

An attempt to reduce the incidence and severity of muscle pains has been carried out. In order to summarize the studies in the literature about the efficacy of pretreatment regimens in reducing postoperative myalgia, a meta-analysis of agents that prevent postoperative myalgia has been published[5]. Three classes of preventive drugs with typical doses have been quoted : nondepolarizing neuromuscular blockers, benzodiazepines (diazepam), and local anesthetics (lidocaine) significantly decreased the frequency of myalgias by about 30 per cent[6]. All pretreatments that were shown to be effective in the meta-analysis were shown to have statistically significant effects in lowering the incidence of myalgia and that, with the available indirect evidence, lidocaine was the best pretreatment to prevent postoperative myalgia.

Hartman, et al[7] suggested that fasciculation was caused by antidromically conducted axonal depolarizations initiated by the agonist action of succinylcholine on prejunctional nicotinic receptors at the neuromuscular junction, leading to the simultaneous contraction of all muscle fibers of individual motor units. Nondepolarizing neuromuscular blocking agents which bind to these prejunctional nicotinic receptor sites can thus block this effect of succinylcholine. Melnick, et al[8] used 1.5 $mg.kg^{-1}$ lidocaine 15 to 30 seconds before succinylcholine was given found it to be effective against postoperative myalgia.

The mechanism of action of lidocaine in decreasing myalgias is only speculative. It was not the purpose of this study to investigate it. We used 1.5 $mg.kg^{-1}$ succinylcholine, the dose recommended when lidocaine is used for pretreatment, and found no obvious effect on intubating conditions.

In our study, pretreatment with lidocaine or intubation with rocuronium were more effective in reducing myalgia. The changes in the heart rate or blood pressure were the same in all three groups. Problems due to bolus injection of lidocaine such as central nervous system toxicity or hemodynanic alteration were not noticed clinically.

SUMMARY

The mechanism by which succinylcholine produces postoperative muscle pain is still not fully understood, although the drug has been in routine clinical use for many years. The mechanism of postoperative myalgia may be complex, involving many steps that can be used as clinical targets for different pretreatment agents[9]. However the most effective way to prevent succinylcholine-induced myalgia is to avoid the use of succinylcholine itself. The use of nondepolarizing neuromuscular blockers with a rapid onset of action and a short duration of clinical effect for intubation may be a reasonable alternative in the prevention of myalgia in surgical patients. In situations where succinylcholine is used because of its superiority in providing fast and good intubating conditions, clinicians can lower the risk of developing postoperative myalgia. Lidocaine has proven to be a useful pretreatment agent for reducing the incidence of postoperative myalgia.

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ประสิทธิผลของไลโดเคนต่อการลดการปวดเมื่อยกล้ามเนื้อหลังผ่าตัดที่เกิดจากซัคซินิลโคลีน

สมชาย อมรโยธิน, พ.บ., อุบลรัตน์ สันตวัตร, พ.บ.*, ปราณี รัชตามุขยนันต์, พ.บ.*, พรรษพร นิลสุวรรณโมษิต, พ.บ.*, หทัยรัตน์ พิพัฒน์นราพงศ์, พ.บ.**

ทำการศึกษาเพื่อเปรียบเทียบผลของไลโดเคนต่อการลดการปวดเมื่อยกล้ามเนื้อหลังผ่าตัดที่เกิดจากซัคซินิลโคลีน การเปลี่ยนแปลงของความดันเลือดและชีพจร และอุบัติการณ์ของการเกิดอาการปวดเมื่อยกล้ามเนื้อหลังผ่าตัดที่เกิดจาก rocuronium ศึกษาในผู้ป่วยหญิงไทยอายุ 15–70 ปี, ASA I หรือ II, งดน้ำและอาหารนานกว่า 6 ชั่วโมงมารับการทำผ่าตัดทางนรีเวชและระยะเวลาการผ่าตัด 1–3 ชั่วโมง แบ่งผู้ป่วยแบบสุ่มออกเป็น 3 กลุ่ม : กลุ่ม PS ได้รับน้ำเกลือนอร์มัลและซัคซินิลโคลีน 1.5 มก/กก กลุ่ม LS ได้รับไลโดเคน 1.5 มก/กก และซัคซินิลโคลีน 1.5 มก/กก กลุ่ม PR ได้รับน้ำเกลือนอร์มัลและ rocuronium 0.6 มก/กก โดยผู้ป่วยทุกคนจะได้รับ morphine 0.1 มก/กก บริหารเข้าหลอดเลือดดำก่อนนำสลบ หลังจากนั้นนำสลบด้วย thiopental 5 มก/กก และใส่ท่อหายใจภายหลังหย่อนกล้ามเนื้อด้วยซัคซินิลโคลีน (กลุ่ม PS และ LS) หรือ rocuronium (กลุ่ม PR) ระหว่างนี้ผู้ร่วมวิจัยที่ไม่ทราบชนิดของยาที่ให้คอยสังเกตการเกิด fasciculation ของกล้ามเนื้อ บันทึกความดันเลือดและชีพจรก่อนและหลังให้ morphine ยานำสลบ ใส่ท่อหายใจ และทุก 2 นาทีหลังจากใส่ท่อหายใจจนครบ 10 นาที บันทึกอาการปวดเมื่อยกล้ามเนื้อ 24 ชั่วโมงหลังผ่าตัดโดยผู้ร่วมวิจัยอีกคนที่ไม่ทราบชนิดของการให้ยา ผลของการศึกษาพบว่า fasciculation ของกล้ามเนื้อในกลุ่ม LS จะพบน้อยกว่ากลุ่ม PS และไม่พบเลยในกลุ่ม PR และหลังผ่าตัด 24 ชั่วโมง จะพบว่ากลุ่ม PS จะมีอาการปวดเมื่อยกล้ามเนื้อหลังผ่าตัดสูงกว่ากลุ่ม LS และกลุ่ม PR อย่างมีนัยสำคัญทางสถิติ โดยพบว่าถ้าให้ไลโดเคนนำก่อนให้ซัคซินิลโคลีนจะลดการเกิด fasciculation ของกล้ามเนื้อและการปวดเมื่อยกล้ามเนื้อ แต่ในกลุ่ม PR แม้จะไม่มี fasciculation ของกล้ามเนื้อก็ยังพบว่ามีอาการปวดเมื่อยกล้ามเนื้อหลังผ่าตัดแต่ก็น้อยกว่ากลุ่ม PS สำหรับการเปลี่ยนแปลงของความดันเลือดและชีพจรทั้ง 3 กลุ่มไม่แตกต่างอย่างมีนัยสำคัญทางสถิติ สรุป จากการศึกษาพบว่า การให้ไลโดเคน 1.5 มก/กก ก่อนนำสลบจะช่วยลดอาการปวดเมื่อยกล้ามเนื้อหลังผ่าตัดที่เกิดจากซัคซินิลโคลีนได้ โดยไม่มีการเปลี่ยนแปลงของความดันเลือดและชีพจร การใช้ rocuronium สำหรับใส่ท่อหายใจก็ลดการเกิดอาการปวดเมื่อยกล้ามเนื้อภายหลังผ่าตัดได้

คำสำคัญ : ไลโดเคน, ซัคซินิลโคลีน, อาการปวดเมื่อยกล้ามเนื้อหลังผ่าตัด

สมชาย อมรโยธิน, อุบลรัตน์ สันตวัตร, ปราณี รัชตามุขยนันต์, พรรษพร นิลสุวรรณโมษิต, หทัยรัตน์ พิพัฒน์นราพงศ์
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* ภาควิชาวิสัญญีวิทยา, คณะแพทยศาสตร์ศิริราชพยาบาล, มหาวิทยาลัยมหิดล, กรุงเทพ ฯ 10700