RESEARCH ARTICLE

USEFULNESS OF PROPOFOL TO PREVENT SUCCINYLCHOLINE INDUCED FASCICULATIONS AND MYALGIA, A COMPARISON WITH THIOPENTONE SODIUM AS AN INDUCTION AGENT

Siddharthkumar Parmar, Atul Vyas, Abdul Sheikh
Department of Anaesthesiology, BJ Medical College, Ahmedabad, Gujarat, India

Correspondence to: Siddharthkumar Parmar (drsid25@gmail.com)

DOI: 10.5455/ijmsph.2013.2.353-357 Received Date: 04.01.2013 Accepted Date: 12.01.2013

ABSTRACT

Background: Succinylcholine induced fasciculations and myalgia may be a source of greater distress to the patient than the surgical pain.

Aims & Objective: This study was designed to see if propofol offered any protection against succinylcholine induced fasciculations and myalgia compared with thiopentone sodium.

Material and Methods: This prospective, randomized study was conducted in a teaching and tertiary care hospital. The study included 99 adult patients scheduled to undergo general anaesthesia for elective surgery. The patients were allocated randomly and equally into Group P1, P2 and T. Anaesthesia was induced in group P1 with propofol 2.5 mg/kg, group P2 with propofol 3.5 mg/kg and group T with thiopentone sodium 5 mg/kg. Tracheal intubation was facilitated by administration of intravenous succinylcholine 2 mg/kg. Incidence and severity of fasciculations were recorded. Anaesthesia was maintained with 50% Nitrous oxide in oxygen, Isoflurane and Vecuronium bromide. At the end of surgery, neuromuscular blockage is reversed and patients were extubated. All the patients were assessed at 6, 12 and 24 hours postoperatively to evaluate the incidence and severity of myalgia. Anova test was applied for quantitative data and Chi-square test for qualitative data. P value < 0.05 was taken as significant.

Results: The demographic data of patients of the three groups were comparable. The total incidence of fasciculations were 25(75.76%), 16(48.48%) and 26(78.79%) in group P1, P2 and T respectively ($p<0.001$). Total score of fasciculations was 44(44.44%), 22(22.22%) and 53(53.54%) in group P1, P2 and T respectively. The severity of fasciculations was reduced more in group P2 than group P1 and T ($p=0.0006$). The total incidence of myalgia were 19(57.57%), 10(30.3%) and 23(69.7%) in group P1, P2 and T respectively ($p<0.001$). Total score of myalgia was 35(35.35), 18(18.18) and 45 (45.45) in group P1, P2 and T respectively. The severity of myalgia was reduced more in group P2 than group P1 and T ($p<0.001$). There was no correlation between fasciculations and myalgia in the present study (Pearson's r correlation, $r = - 0.139$).

Conclusion: Propofol 3.5 mg/kg in comparison with propofol 2.5 mg/kg and thiopentone sodium 5 mg/kg is effective in reducing the incidence and severity of succinylcholine induced fasciculations and myalgia.

KEY-WORDS: Succinylcholine; Fasciculations; Myalgia; Propofol; Thiopentone

Introduction

Succinylcholine is still the accepted standard to facilitate tracheal intubation in developing country like India, despite the recent introduction of short acting non depolarizing neuromuscular blockers. Fasciculations during induction and post-operative myalgia are unpleasant consequence of the use of succinylcholine. It may be a source of greater distress to the patient than the surgical wound pain. Incidence and severity of fasciculations and myalgia vary widely. Various attempts have been made to decrease the fasciculations and myalgia with variable success. So, this study was designed to see if propofol offered any protection against succinylcholine induced fasciculations and myalgia compared with thiopentone sodium.

Materials and Methods

The prospective, randomized, controlled clinical study was conducted in tertiary care hospital and teaching institute after obtaining approval of institutional ethical committee and written informed consent of patients. The study was carried out in 100 patients of sex, aged 18 to 60 years, American Society of Anaesthesiologist (ASA) physical status 1 or 2, scheduled to undergo general anaesthesia for elective surgery. Patients

with known cardiovascular, pulmonary, neuromuscular or metabolic diseases and those with an impaired renal or hepatic function, morbid obese, pregnancy and a history of drug abuse were excluded.

The patients were randomized using computer generated random numbers into three groups: P1, P2 and T. Group P1, P2 and T were allotted 33, 33 and 34 patients respectively.

All patients were fasted for 6 hours before surgery. All patients were premedicated with glyco pyrrolate 0.004 mg/kg and preloaded with dextrose normal saline (DNS) solution 10 ml/kg intravenously (I.V.) just before 15 minutes. Anaesthesia was induced in group P1 with propofol 2.5 mg/kg, group P2 with propofol 3.5 mg/kg and group T with thiopentone sodium 5 mg/kg IV. All groups were given succinylcholine 2 mg/kg I.V. to facilitate insertion of an endotracheal tube. All patients were observed for incidence and severity of fasciculations. Severity of fasciculation was graded as: Grade 0 (nil) = absence of visible fasciculations; Grade 1 (mild) = fine fasciculations of the eyes, face, neck, or fingers without limb movements; Grade 2 (moderate) = obvious, reasonable fasciculations on more than one site of body or movement of limbs; Grade 3 (severe) = vigorous, sustained and widespread fasciculations. Laryngoscopy and tracheal intubation were performed after cessation of fasciculations or 1 minute after succinylcholine injection. Anaesthesia was maintained with 50% Nitrous oxide in oxygen with Isoflurane as an inhalation agent. Diclofenac sodium 75 mg was injected intramuscularly for surgical pain. Vecuronium bromide I.V. was used to facilitate muscle relaxation. At the end of procedure, the patient's neuromuscular blockage is reversed and extubated. All patients were observed for hemodynamic stability and adverse effects were recorded specifically after induction and intubation.

All the patients were assessed in respective ward at 6, 12 and 24 hours after the surgery to evaluate the incidence and severity of myalgia. An attempt has been made not to let know the patient that myalgia was of special interest.

Muscle pain not related to surgical intervention was graded as: Grade 0 (nil) = absence of muscle pain; Grade 1 (mild) =minor stiffness of transient duration and localized to one site; Grade 2 (moderate) = muscle pain to multiple sites or severe pain to one site; Grade 3 (severe) = widespread muscle pain, severe pain to more than one site, disability confining patient to the bed, muscle pain severe than pain of surgical site, no adequate sleep due to muscle pain.

Statistical Analysis

Date was analyzed using Microsoft excel 2010 software. We summarized data as mean ± SD or Number (percentage). Anova test was applied for quantitative data and Chi-square test for qualitative data. Pearson r correlation was used to correlate the fasciculations and myalgia. P value < 0.05 was taken as significant.

Results

The demographic data of patients of the three groups were comparable. The total incidence of fasciculations were 25 (75.76%), 16 (48.48%) and 26 (78.79%) in group P1, P2 and T respectively ($p<0.001$). Total score of fasciculations was 44 (44.44%), 22 (22.22%) and 53 (53.54%) in group P1, P2 and T respectively. The severity of fasciculations was reduced more in group P2 than group P1 and T ($p=0.0006$).

The total incidence of myalgia were 19 (57.57%), 10 (30.3%) and 23 (69.7%) in group P1, P2 and T respectively ($p<0.001$). Total score of myalgia was 35 (35.35), 18 (18.18) and 45 (45.45) in group P1, P2 and T respectively. The severity of myalgia was reduced more in group P2 than group P1 and T ($p<0.001$).

There was no correlation between fasciculations and myalgia in the present study (Pearson's r correlation, $r = - 0.139$).

Incidence of hypotension after administration of induction agent was comparable in all groups ($p=0.0779$). Incidence of tachycardia and hypertension after tracheal intubation was 1(3.03), 1(3.03) and 4(12.12) in group P1, P2 and T respectively ($p<0.0079$).

Table-1: Demographic Data of Patients

Parameter	Group P1	Group P2	Group T
Age (Mean ± SD)	31.64 ± 10.73	28.36 ± 10.99	32.27 ± 11.78
Sex ratio (M:F)	17:16	15:18	17:16
ASA Grade (I:II)	31:2	31:2	28:5

Table-2: Incidence & Severity of Fasciculations and Myalgia

Parameter		Group P1 N (%)	Group P2 N (%)	Group T N (%)	P value
Fasciculations	Incidence	25 (75.76)	16 (48.48)	26 (78.79)	<0.001
	Nil	8 (24.24)	17 (51.52)	7 (21.21)	0.0006
	Mild	11 (33.33)	11 (33.33)	7 (21.21)	
	Moderate	9 (27.27)	4 (12.12)	11 (33.33)	
	Severe	5 (15.15)	1 (3.03)	8 (24.24)	
	Total Score	44 (44.44)	22 (22.22)	53 (53.54)	<0.001
Myalgia	Incidence	19 (57.57)	10 (30.3)	23 (69.7)	<0.001
	Nil	14 (42.42)	23 (69.69)	10 (30.3)	0.0083
	Mild	8 (24.24)	4 (12.12)	7 (21.21)	
	Moderate	6 (18.18)	4 (12.12)	10 (30.3)	
	Severe	5 (15.15)	2 (6.06)	6 (18.18)	
	Total Score	35 (35.35)	18 (18.18)	45 (45.45)	<0.001

Table-3: Adverse Effects of Induction Agents among Study Groups

Time	Parameter	Group P1 N (%)	Group P2 N (%)	Group T N (%)	P value
Post-Induction	Hypotension	1 (3.03)	3 (9.09)	1 (3.03)	0.0779
Post-Intubation	Tachycardia	1 (3.03)	1 (3.03)	4 (12.12)	0.0079
	Hypertension	1 (3.03)	1 (3.03)	4 (12.12)	0.0079

Discussion

Succinylcholine is a popular and widely used drug in anaesthesia practice as it provides the ideal intubating conditions for short and emergency surgical procedures. But usefulness of it is limited by frequent occurrence of fasciculations and myalgia which may be a source of greater pain than surgical pain.

Pre-treatment with diclofenac[1], ketorolac[2], calcium[3], diazepam[4], lignocaine[5], magnesium[6], small dose of succinylcholine as self-taming[7], atracurium[8], rocuronium[9], cisatracurium[10], remifentanyl[11], gabapentin[12], d-tubocurare[13], pancuronium[14], vecuronium[15] etc. have been tried to reduce or prevent succinylcholine induced fasciculations and myalgia but, none of them were thoroughly successful. The most effective method is pre-treatment with a small dose of non-depolarizing agent but it is associated with blurred vision, diplopia, and difficulty in breathing and higher dose of succinylcholine to obtain optimal intubating condition which leads to a longer recovery and apnoea period. Cost and availability may also limit its usage especially in developing country.

This study show that propofol in higher dose effectively reduces the incidence & severity of succinylcholine induced fasciculations and myalgia compared with thiopentone. The mechanism for this protective effect is not known.

Kararmaz A et al[16] found in their study to compare the effects of thiopentone 5 mg/kg in group I, propofol 2 mg/kg in group II and propofol 3.5 mg/kg in group III on succinylcholine induced fasciculations and myalgia in 90 women who underwent laparoscopy. Severity of fasciculations in group III was significantly lower than in the other two groups (p=0.01). 70% of patients had no myalgia in group III, 39.2% in group II and 37% in group I (p=0.011). Severity of myalgia was also significantly lower in group II compared with the other two groups (p=0.011). Post-operative creatine kinase levels were significantly higher than their baseline values in groups I and II (p<0.0001). They concluded that high dose of propofol is effective in reducing succinylcholine induced fasciculations and myalgia.

C. Mc Clymont[17] conducted a single blind study in 48 women undergoing laparoscopic gynaecological procedures to assess the incidence of succinylcholine induced myalgia. He has induced the patients with thiopentone or propofol sufficient to abolish the eyelash reflex. Succinylcholine 1 mg/kg was used to facilitate insertion of an endotracheal tube and anaesthesia was maintained with 66% nitrous oxide in oxygen with isoflurane and fentanyl given as required for analgesia. No other muscle relaxants were given. He found that the propofol group (19%) had a significantly lower incidence of myalgia compared with the thiopentone group (63%) (p < 0.05).

Manataki AD, et al[18] conducted a single blinded study to evaluate the effect of continuous propofol administration on creatine kinase and succinylcholine induced myalgia in 50 patients. Induction of anaesthesia was identical in all patients. Anaesthesia was maintained with 66% nitrous oxide in oxygen supplemented by either isoflurane 1% or continuous propofol. The median level of myalgia was reduced significantly

in the continuous propofol group (p=0.011) and the median creatine kinase value increased significantly in the isoflurane group (from 90 to 160 IU, p=0.001).

Maddineni VR, et al[19] concluded that neither the induction agent nor the time between the induction agent and succinylcholine administration has any significant influence on the incidence or muscle pains or creatine kinase elevation following succinylcholine.

Literature analysis[20] reveals that the presynaptic activity of succinylcholine produces fasciculations. These involuntary contractions produce muscle damage, manifested as myalgia, myoglobinemia, an increase in creatine kinase. Our study corresponds with a meta-analysis[21] reporting that there is no direct correlation between intensity of fasciculation and frequency of myalgia, and it is more likely that the aetiology of myalgia is multifactorial.

Propofol induces anaesthesia rapidly and smoothly, is associated with a quick recovery and has a lower incidence of postoperative nausea and vomiting (PONV) than other agents[22] like thiopentone[23] and volatile agents[24]. It does not have cumulative effects even on prolonged infusion.

According to the present study, the usage of propofol reduces the incidence and severity of fasciculation caused by succinylcholine. This effect can be very useful when using succinylcholine in emergency situations by reducing the risk of regurgitation of gastric contents, since it is known that in adults the intensity of fasciculation is directly related with the increase of intra-gastric pressure in adults[25].

In the present study, incidence of hypotension after administration of induction agent in the study was comparable in all groups. Incidence of tachycardia and hypertension was more in thiopentone than propofol ($p < 0.0079$) after intubation in the present study. So, the present study corresponds with the other study[26] that propofol has the advantage of blocking the sympathetic activation during tracheal intubation.

Limitation of the study is non-blinding methodology of the study. The present study forms just a preliminary report of this aspect and results are encouraging.

The simple and effective way of minimizing the incidence and severity of succinylcholine induced fasciculation and myalgia is by:

- Restricting its use.
- Use of newer short to intermediate acting non-depolarizing agents to facilitate tracheal intubation instead of succinylcholine.
- Use of laryngeal mask airway which decreases the number of cases where tracheal intubation is necessary.

Conclusion

Propofol 3.5 mg/kg in comparison with propofol 2.5 mg/kg and thiopentone sodium 5 mg/kg is effective in reducing the incidence and severity of succinylcholine induced fasciculations and myalgia.

References

1. Kahraman S. Ercan S, Aypar U, Erdem K. Effect of preoperative I.M. administration of diclofenac on suxamethonium-induced myalgia. Br J Anaesth 1993;71:238:41.
2. Leeson Payne C. Nicoll JM, Hobbs GJ. Use of Ketorolac in the prevention of suxamethonium myalgia. Br J Anaesth 1994;73:788-90.
3. Shrivastava OP, Chatterji S, Kachhawa S, Daga SR. Calcium gluconatepretreatment for prevention of succinylcholine induced myalgia. AnesthAnalg 1983;62:59-62.
4. Fahmy NR, Malek NS, Lappas DG. Diazepam prevents some adverse effects of succinylcholine. Clin Pharmacol Ther 1979;26:395-8.
5. Raman SK, San WM. Fasciculations, myalgia and biochemical changes following succinylcholine with atracurium and lidocainepretreatment. Can J Anaesth 1997;44:498-502.
6. Kumar M, Talwar N, Goyal R, Shukla U, Sethi AK. Effect of magnesium sulphate with propofol induction of anesthesia on succinylcholine-induced fasciculations and myalgia. J Anaesth Clin Pharmacol 2012;28:81-5.
7. Baraka A. Self-taming of succinylcholine-induced fasciculations. Anesthesiology 1977; 46:292-3.
8. Hochhalter CM. Evaluation of succinylcholine-induced fasciculations and myalgias with or without atracurium pretreatment. AANA J. 1996; 64(4):336-40.
9. Farhat K, Waheed A, Pasha AK, Kazi WA. Prevention of succinylcholine induced muscular

effects by pretreatment with rocuronium. Pakistan journal of pharmacology 2012; 29(1): 25-31.
10. Joshi GP, Hailey A, Cross S, Thompson-Bell G, Whitten CC. Effects of pretreatment with cisatracurium, rocuronium, and d-tubocurarine on succinylcholine-induced fasciculations and myalgia: a comparison with placebo. J Clin Anesth. 1999;11(8):641-5.
11. Yun M, Kim YH, Go YK, Shin JE, Ryu CG, Kim W, et al. Remifentanil Attenuates Muscle Fasciculationsby Succinylcholine. Yonsei Med J 2010; 51(4):585-9.
12. Pandey CK, Tripathi M, Joshi G, Karna ST, Singh N, Singh PK. Prophylactic use of gabapentin for prevention of succinylcholine-induced fasciculation and myalgia: a randomized, double-blinded, placebo-controlled study. J Postgrad Med 2012;58(1):19-22.
13. Demers-Pelletier J, Drolet P, Girard M, Donati F. Comparison of rocuronium and d- tubocurarine for prevention of succinylcholine-induced fasciculations and myalgia. Can J Anaesth 1997; 44:1144-7.
14. Broadsky JB, Brock-Utme JG, Samuels SI. Pancuronium pretreatment and post succinylcholine myalgias. Anesthesiology 1979; 51:259-61.
15. Ferres C, Mirakhur R, Craig H, Browne E, Clarke R. Pre-treatment with Vecuronium as a prophylactic against post- suxamethonium muscle pain: comparison with other nondepolarising neuromuscular blocking drugs. Br J Anaesth 1983; 55:735-41.
16. Kararmaz A, Kaya S, Turhanoglu S, Ozyilmaz MA. Effects of high dose propofol on succinylcholine induced fasciculations and myalgia. Acta Anaesthe Scandinavica 2003;47(2):180-3.
17. McClymont C. A comparison of the effect of propofol or thiopentone on the incidence and severity of suxamethonium-induced myalgia. Anaesth Intens Care 1994; 22:147-9.
18. Manataki AD, Arnaoutoglou HM, Tefa LK, Glatzounis GK, Papadopoulos GS. Continuous propofol administration for suxamethonium-induced postoperative myalgia. Anaesthesia 1999; 54(5):419-22.
19. Maddineni VR, Mirakhur RK, Cooper AR. Myalgia and biochemical changes following suxamethonium after induction of anaesthesia with thiopentone or propofol. Anaesthesia 1993; 48(7):626-8.
20. Wong AF, Chung F. Succinylcholine-associated postoperative myalgia. Anaesthesia 2000; 55(2):144-152.
21. Schreiber JU, Lysakowski C, Fuchs-Buder T, Tramer MR. Prevention of succinylcholine-induced fasciculation and Myalgia. A meta-analysis of randomizedtrials. Anesthesiology 2005; 103:877-84.
22. Fulton B, Goa KL. Propofol: A pharmacoeconomic appraisal of its use in day case surgery. Pharmacoeconomics 1996;9(2):168-78.
23. Myles PS, Hendrata M, Bennett AM, Langley M, Buckland MR.Postoperative nausea and vomiting. Propofol or thiopentone: does choice of induction agent affect outcome? Anaesth Intensive Care 1996;24(3):355-9.
24. Jost U, Dörsing C, Jahr C, Hirschauer M. Propofol and postoperative nausea and/or vomiting. Anaesthesist 1997; 46(9):776-82.
25. Miller RD, Way WL. Inhibition of succinylcholine-induced increased intragastric pressure by nondepolarizing muscle relaxantsand lidocaine. Anesthesiology 1971;34:185-8.
26. Lindgren L, Yli-Hankala A, Randell T, Kirvelä M, Scheinin M, Neuvonen PJ. Haemodynamic and catecholamine responses to induction of anaesthesia and tracheal intubation: comparison between propofol and thiopentone. Br J Anaesth 1993;70(3):306-10.

Cite this article as: Parmar SB, Vyas AB, Sheikh AN. Usefulness of propofol to prevent succinylcholine induced fasciculations and myalgia, a comparison with thiopentone sodium as an induction agent. Int J Med Sci Public Health 2013; 2:339-343.
Source of Support: Nil
Conflict of interest: None declared