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Effects of Low Dose Rocuronium on Laryngeal Mask Airway Applications

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Abstract:

Aim: The aim of this study is, to investigate the effects of low dose rocuronium, on laryngeal mask airway (LMA) insertion success, additional propofol requirement, surgical satisfaction and recovery time.

Material and Methods: A total of 96 male patients who underwent cystoscopy with LMA were included in this study. Patients were divided into two groups and 2.5 mg / kg propofol, 1.5 mcg / kg fentanyl, and 0,15 mg / kg rocuronium were administered to the study group (Group PFR), while propofol,fentanyl and saline with same doses to the control (group PF). LMA insertion success, hemodynamic parameters, body movements during operation, total propofol consumption, recovery time, surgical satisfaction and post-operative sore throat were evaluated.

Results: The LMA insertion success in Group PFK was statistically higher than Group PF (p = 0,003). There was no significant difference between the groups in terms of hemodynamic parameters. Undesirable body movements were higher in group PF (p=0,001). Total propofol dose was statistically higher in PFR (p = 0,009). Patients in group PFR had a shorter recovery time than group PF (p = 0,011). The surgical satisfaction level was statistically higher in PFR group (p = 0,001). There was no significant difference between the groups in terms of postoperative sore throat (p = 0,65).

Conclusion: The use of low dose rocuronium with LMA application in urological endoscopic procedures has increased the LMA insertion success. The use of low-dose rocuronium reduced total propofol consumption in patients and shortened the recovery time.

Keywords: Cystoscopy, LMA, Muscle Relaxants, Rocuroium, Noromuscular Blocker.

Introduction:

A laryngeal mask airway (LMA) is a useful device in patients who undergo short operational procedures such as cystoscopy [1]. It is known that LMA usage reduces postoperative pharyngolaryngeal complications including sore throat, dysphagia, and dysphonia compared to endotracheal intubation [2]. Because of LMA insertion may provoke upper airway reflexes, sufficient mouth opening and adequate depth of anesthesia is necessary for successful insertion of the LMA [3].

Propofol is an anesthesia induction agent, which depressing effects on the laryngeal reflexes are more than other induction agents, resulting in less coughing, gagging and laryngospasm [1].

Muscle relaxation is essential to reduce the tracheal intubation response and muscle tension during general anesthesia and provides suitable conditions for the surgical operations [4]. Neuromuscular blockers promote the expansion of pharyngeal anatomy and facilitate insertion of LMA [5]. There are little information has been published about ideal doses of neuromuscular agents in LMA insertion. However, some studies reported about muscle relaxants, which may not be required when inserting the LMA [6,7].

The aim of this study was to investigate the effects of low dose rocuronium on LMA insertion success, additional propofol requirement, surgical satisfaction and recovery time in patients which cystoscopy were performed with LMA using propofol-fentanyl induction.

Materials and Methods:

Patients Selection:

Local ethical committee of Erciyes University approved this study. Written informed consent was received from each patient during preoperative visit. From April 2016 to July 2017, 96 ASA I and II, male patients aged between 18-65 years scheduled cystoscopy were included in this study.

Patients with cardiovascular, respiratory, hepatic, renal or neuromuscular diseases, allergy to drugs in the study and uncontrolled hypertension and diabetes mellitus were excluded from the study. Non-cooperated patients, women and children and body mass index 30> kg/m^2 patients were also excluded. All patients were fasted for six hours.

Study Methods:

Patients were monetarized intra-operatively with standard monitoring parameters including electrocardiography (lead II ECG), heart rate (HR), non-invasive systolic arterial pressure (SAP), diastolic arterial pressure (DAP), mean arterial pressure (MAP), peripheral oxygen saturation (SpO_2), end-tidal carbon dioxide tension ($ETCO_2$), bispectral index (BIS) in supine position. HR, SpO_2, SAP, DAP and MAP recorded in 10 minutes intervals and patients were divided into two groups randomly. Induction of anesthesia were performed with 2.5mg/kg propofol and 1.5 µg/kg fentanyl and 0.15 mg/kg rocuronium in 5 ml in study group (Group PFR) and 2.5 mg/kg propofol, 1.5 fentanyl and 5 ml saline in control group (Group PF) by an anesthesiologist who were blinded to patients. LMA was inserted after 2 minutes of induction. Mouth opening was evaluated for "total, partial or none".

Patient body weight was used as a reference to determine sizing (4 or 5) according to the manufacturer's guidelines and cuff of the masks were pumped with 30-40 ml air according to the size.

The ease of the insertion of LMA was recorded as "successful" for the first attempt and "failed" for the second/ third attempt or unplaced. Patients with third attempt were recorded as "impossible of the insertion of LMA" and intubated with whole dose of neuromuscular agent and excluded from the study.

Maintenance of anesthesia was provided with 4 mg/kg/h propofol infusion and % 50/ % 50 oxygen and nitrous oxide mixture. Any complications such as hypertension, hypotension, tachycardia or bradycardia were recorded.

BIS monitorization was also performed to all patients in both groups. When the BIS value was below 40, LMA was inserted and the number of the BIS exceeds 60 was noted. BIS value were between 40-60 and when there was any body movement during the operation or the BIS value increased above 60, additional 0.5 mg / kg propofol was administered. Respiration frequency and $ETCO_2$ were adjusted as 10-14/min and between 32-36 mmHg from the LMA insertion to the end of the operation.

Heart rate, mean arterial pressure, SpO_2 of the baseline, post-induction, and after LMA insertion were recorded. Additional drugs in the period of induction and maintenance were also evaluated.

Surgical satisfactions were asked to the surgeons at the end of the operation with the based on Likert scale which is scored from 1 to 5 (1: dissatisfied, 2: bad, 3: average, 4: good, 5: excellent satisfaction).

Propofol infusion was discontinued around 5 minutes before the surgery was over and % 100 oxygen was inhalated. LMA was extracted when the patient had spontaneous respiration. The time from propofol infusion stopped to Alderett recovery score with 9 was recorded as recovery time. Sore throat was also evaluated in all patients and intravenous 1 gr parasetamol was administered for post-operative analgesia if it was necessary.

Statistical Analyses:

Data were analyzed using SPSS software (version 13.0; SPSS, Inc., Chicago, IL, USA). Between groups numerical data with normal distribution were analyzed with student t test and Mann Whitney U test was used for comparison of data without normal distribution. Categoric variables were analyzed using chi-square test. Quantitative data were P<0.05 indicated a statistically significant result presented by means ± SD.

Results:

A total of 96 male patients were included in this study and divided into two groups as study (n=48) and control (n=48).

Body weight, height of the patients, number of ASA I -II patients in both groups, and total operation time was evaluated and there are no significant differences between groups (Table 1).

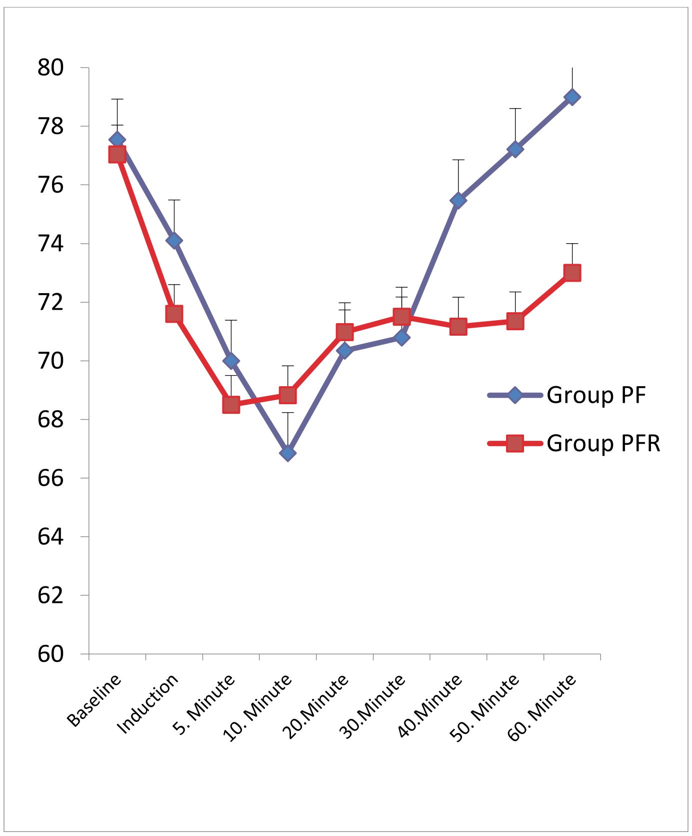
Table 1: Demographic data of the patients and operation times in Group PFR and Group PF

	Group PFR (n=48) Mean±Standart Deviation		Group PF (n=48) Mean±Standart Deviation		*p*
Height (cm)	171,56±5,12		170,40±5,20		*0,271*
Weight (kg)	81,06±16,46		75,38±13,06		*0,064*
Operation time (minute)	39,80±12,63		42,71±12,67		*0,262*
ASA I	Number (n)	Percentage (%)	Number (n)	Percentage (%)	0,83
	24	50	26	54,2	
ASA II	24	50	22	45,8	

LMA insertion was successful in all patients in group PFR and 10 failed in group PF. LMA was inserted with second attempt in 10 failed patients in group PF and endotracheal intubation was not performed to any of the patients. Success rate was 100% in PFR group and 79,2 % in PF group and there is significant difference between groups according to LMA insertion success with first attempt (p=0,003).

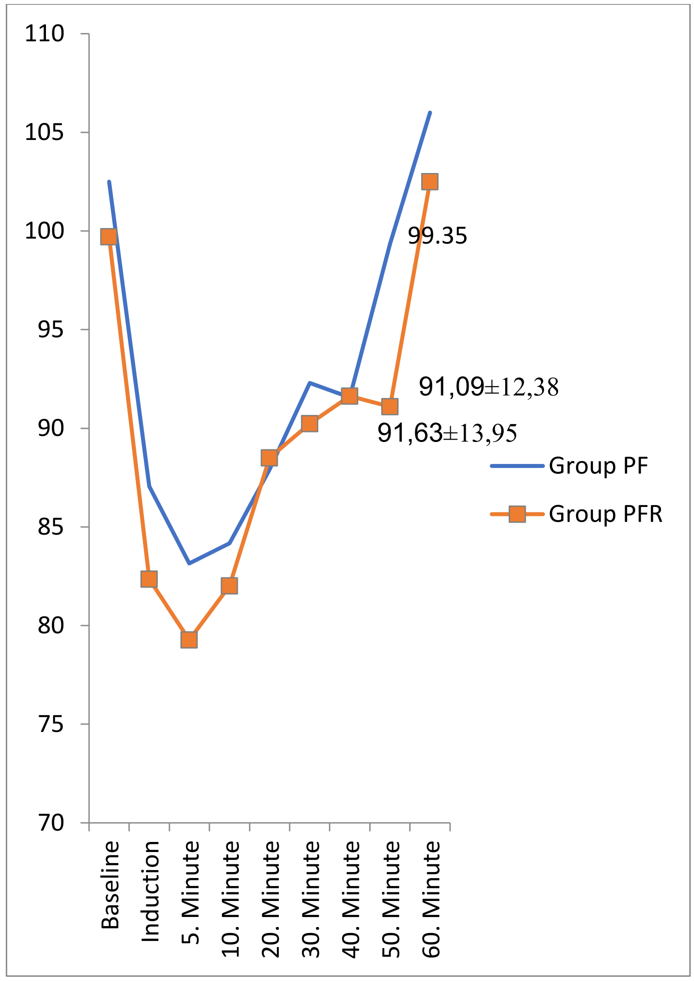
When the mean heart rate (HR) and peripheral oxygen saturation (SpO_2) of the baseline, during induction and 1hour post-induction was compared and there are no significant differences were found between groups (Figure 1).

Figure 1: Baseline, induction and post-induction heart rates in group PFR and PF



Mean arterial pressure (MAP) of baseline, induction and 1hour post-induction was compared between groups and significant difference was found only measurements of 50. minute of post-induction and there is no significant difference in other measurements (Figure 2).

Figure 2: Baseline, induction and post-induction mean arterial pressure in group PFR and PF



Body movement of the patients during the operation and BIS values >60 were compared between study and control groups. While none of the patients moved during the operation in PFK group, 24 patients had undesirable body movements in PF group and the difference was significant (p=0,001). The numbers of BIS value exceed 60 were recorded in both groups (Table 2). There were no significant differences between groups according to the number of BIS values above 60 (p=0,27).

Table 2: The numbers of BIS value exceed 60 and the presence of body movements of the patients between groups

		Group PFR (n=48)		Group PF (n=48)		*p*
		Number (n)	Percentage (%)	Number (n)	Percentage (%)	
The numbers of BIS value exceed 60	0	16	33,3	17	35,4	*0,27*
	1	18	37,5	21	43,8	
	2	14	29,2	8	16,7	
	3	0	0,0	2	4,2	
Body movement	No(-)	48	100,0	24	50,0	***<0,001***
	Yes(+)	0	0,0	24	50,0	

Additional propofol requirement was compared between the groups. Mean additional propofol dose was 188,13±103,83 mg in PFR group and 238,54±79,52 mg in PF group, and the difference was significant statistically (p=0,009). Recovery time was 5,69±1,06 minutes in PFR patients and 6,25±1,06 minutes in PF group and it was statistically higher in control patients than study patients (p=0,011, Table 3).

Table 3: Mean recovery time and dosage of additional propofol in Group PFR and Group PF

	Group PFR (n=48) Mean±Standart Deviation	Group PF (n=48) Mean±Standart Deviation	*p*
Recovery Time (minute)	5,69±1,06	6,25±1,06	***0,011***
Additional propofol (mg)	188,13±103,83	238,54±79,92	***0,009***

Surgical satisfaction scores were evaluated in both groups. Mean satisfaction rate was 4,58±0,50 in PFR group and 3,73±1,03 in PF group and there were significant differences between study and control groups (p=0.001). Surgeon satisfaction is shown in Table 4.

Table 4: Surgical satisfaction rates during the operation in study and control groups

		Group PFR (n=48)		Group PF (n=48)		*p*
		Number (n)	Percentage (%)	Number (n)	Percentage (%)	
Surgeon satisfaction scores	**1**	0	0.0	0	0.0	***<0,001***
	2	0	0,0	6	12,5	
	3	0	0,0	15	31,3	
	4	20	41,7	13	27,1	
	5	28	58,3	14	29,2	

Post-operative sore throat was observed in 2 patients in PFR group and 3 patients in PF group and the difference was not significant (p=0,65). There were no minor or major airway-related complications, aspiration, cardiac complications or post-operative nausea and vomiting noted in both groups.

Discussion

In our study, we showed that low dose rocuronium applied during LMA placement improves LMA placement quality, reduces total propofol dose requirement and creates comfortable working conditions for the surgeons.

LMA has more convenient hemodynamic profile and lower risk of airway complications including laryngospasm, postoperative hoarseness and coughing compared to endotracheal intubation [8,9]. Furthermore, lower doses of sedative and anesthetic agents are needed with the reduction in airway stimulation in LMA procedures, resulting in a shorter recovery time [10].

There are various reports in the literature about adequate doses and effectiveness of rocuronium during LMA procedures Fujiwara et al. reported a randomized clinical trial to examine insertion efficacy and sealing pressure of Prosomal LMA with muscle relaxant administration. 80 adult patients had been included to the study as muscle relaxant group or not. After the induction with propofol and fentanyl, 0.9 mg /kg rocuronium had been administered to study group and number of attempts required for successful insertion and sealing pressure had been compared between groups. They reported that, muscle relaxation facilitates LMA insertion efficacy and increase sealing pressure [5,11-13].

Muscle relaxants increase the effectiveness of ventilation by suppressing the upper airway [5]. In cases which muscle relaxant is not used, complications such as inadequate mouth opening, difficulty of insertion of the mask, involuntary muscle movements, sore throat during post-operative period may be encountered during LMA applications [14].

Gong et al investigated whether low-dose muscle relaxant is necessary in preventing ventilation leak of flexible LMA in radical mastectomy. All the included patients had received total intravenous anesthesia (with propofol, fentanyl and remifentanil) and patients in muscle relaxant (MR) group had received 0.4 mg/kg rocuronium during anesthesia induction. Insertion time had been found shorter in MR group than non-MR group and peak airway pressures and ventilation leak volumes had been lower in MR group. The results show that low-dose rocuronium could reduce the ventilation leak for mechanical ventilation with flexible LMA (15). In our study results, the success of LMA insertion in first attempt was 100 % in study group and 79.2 % in control group, and the difference was found statistically significant ($p = 0.003$). Undesirable body movements during the operation, additional propofol requirements were statistically higher in control group compared to study group in this study [15].

On the other hand, there is an idea in the literature about muscle relaxants are not necessary during LMA procedures. Chen et al. evaluated the muscle relaxant requirement in laparoscopic gynecological procedures during general anesthesia with Proseal LMA. 120 patients had been included to the study and they had been randomly divided into two groups to receive a muscle relaxant or not. Peak airway inflation pressures, airway sealing pressure, minimum flow rate, recovery time, frequency of sore throats and surgical conditions had been assessed. There had been no difference between groups according to airway observations, sore throats and surgical conditions, but recovery time had been found higher in muscle relaxant group. They concluded that, muscle relaxants are not necessary in general anesthesia with Proseal LMA [14].

Muscle relaxants may cause prolonged neuromuscular block and neuromuscular antagonist should be used to reverse such a block, which results in prolongation of recovery time [14]. In contrary to the belief, as a result of our study, 0.15 mg / kg rocuronium did not increase the recovery time and it was thought to be due to a significant reduction in the need for additional profile during the procedure when using a low-dose muscle relaxant. In our study, surgical satisfaction was also evaluated. The satisfaction rate in the study group was higher than control group and the difference was significant (p = 0.001). Surgical satisfaction was associated with reduction of the undesirable body movements of the patients during the operation and shortened recovery time.

In conclusion, the use of low dose rocuronium increased the LMA insertion success, surgical satisfaction and reduced total propofol consumption and recovery time. 0,15 mg/kg rocuronium can be used safely during urological endoscopic procedures with LMA applications.

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