

Rocuronium versus Vecuronium for laparoscopic cholecystectomy

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ABSTRACT

Background: Laparoscopic cholecystectomy under general anaesthesia using Vecuronium is quite common these days. Some alarming complications like severe bradycardia and asystole after creation of carboperitoneum is not uncommon after its injection which is very stressful to both surgeons and anaesthesiologists. As an alternative, Rocuronium has been found safe in this regard till now used in many general anaesthesia requiring cases. So, it can be useful in laparoscopic cholecystectomy as well.

Objective: To compare the haemodynamic, respiratory parameters and complications between Vecuronium and Rocuronium.

Methods: In this randomised prospective double blind study conducted at Kathmandu Medical College from March 2013 to September 2013, a total of sixty patients of American Society of Anaesthesiologist (ASA) physical status I and II planned for laparoscopic cholecystectomy were randomly divided into two groups of thirty each by envelope method, with one group receiving Rocuronium and the other group receiving Vecuronium as muscle relaxants. Group A received injection Pethidine 1 mg/kg, Propofol 2.5 mg/kg and Vecuronium 0.1 mg/kg for induction. Group B received injection Pethidine 1 mg/kg, Propofol 2.5 mg/kg and Rocuronium 0.6 mg/kg for induction. After intubation the whole anaesthesia was maintained with oxygen, air, halothane and intermittent positive pressure ventilation. Intraoperative monitoring used were Pulse rate (PR), mean arterial pressure (MAP), arterial Oxygen saturation (SpO₂), end tidal Carbondioxide (ETCO₂), electro cardiography (ECG) and peripheral nerve stimulator (PNS). PR, MAP, SpO₂, ETCO₂, ECG were recorded before muscle relaxant, one minute after muscle relaxant, before intubation, one minute after intubation, before skin incision, one minute after skin incision, before carboperitoneum, one minute after carboperitoneum, before extubation and one minute after extubation. Carboperitoneum if occurred any were also noted. Statistical analysis was done by using SPSS 19 version. Student t test, Fisher's exact test and Chi square test were used for the final analysis where P value <0.05 was considered significant.

Result: Using Vecuronium as a muscle relaxant for laparoscopic cholecystectomy resulted in haemodynamic alteration intraoperatively by a significant reduction of PR one minute after carboperitoneum (62.80±11.25 versus 87.23±14.35 in Rocuronium group) where p<0.05. Bradycardia requiring Atropine was significant in vecuronium group with p<0.05.

Conclusion: Rocuronium is less likely to cause bradycardia as compared to Vecuronium in laparoscopic cholecystectomy.

Keywords: Cholecystectomy Laparoscopic, Haemodynamic, Pulmonary Paramaters, Rocuronium, Vecuronium.

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INTRODUCTION

Laparoscopic cholecystectomy is one of the common operations performed worldwide these days and so is true in our country as well. It offers several advantages over the open technique like reduction of stress response of surgery and anaesthesia intraoperatively, decrease in postoperative pain, reduction in pulmonary

complications, decreased chance of wound infection and fast recovery with good cosmetic appearance^{1,2}. Some important disadvantages are due to physiological effects of intraoperative carbondioxide insufflations (carboperitoneum) which causes major impacts on cardiorespiratory system. On cardiovascular system carboperitoneum can cause hypercapnoea leading to activation of sympathetic nervous system and increase in pulse rate, blood pressure and occurrence of dysarrhythmias. Increased intra-abdominal pressure can cause venous compression leading to decrease preload, similarly severe bradycardia and asystole can occur if intense vagal stimulation occurs during trocar and needle insertion and peritoneal stretch³. Physiological changes in pulmonary system includes decrease lung volume and capacity, increase peak airway pressure, cephalad movement of diaphragm and reduced excursion, increase incidence of ventilation, perfusion mismatch, pneumothorax and pneumomediastinum^{4,5}. When general anaesthesia is chosen good muscle relaxation with minimum alteration of cardiorespiratory function is beneficial. Vecuronium or Rocuronium both are used quite frequently in laparoscopic cholecystectomy these days but Vecuronium has been shown to cause increased incidence of bradycardia and even cardiac arrest in some cases especially after creation of carboperitoneum under general anaesthesia maintained with oxygen and Halothane⁶. Rocuronium on the other hand has been shown to have stable haemodynamics in maximum general anaesthesia requiring operations maintained similarly.

In our present study we have compared cardiorespiratory effects and complications between Vecuronium and Rocuronium during laparoscopic cholecystectomy maintained under general anaesthesia with oxygen and halothane.

METHODS

This randomized prospective double blind study was conducted at Kathmandu Medical College Teaching Hospital from March 2013 till September 2013 after ethical clearance from the ethical committee of the institute and informed written consent from the participants of the study. Sixty adult patients of both gender aged 20 to 60 years, weighing 40 to 65 kg and belonging to American Society Of Anaesthesiologist (ASA) class I and II posted for laparoscopic cholecystectomy under general anaesthesia were included in the study. The exclusion

criteria were patients not meeting above criteria, having difficult airways, having significant cardiorespiratory and hepato-renal disease. Pre-anaesthetic evaluation was done one day prior to surgery and all the patients received tablet Diazepam 5 mg, Ranitidine 150 mg and Metoclopramide 10 mg the night before the surgery. Sample size was calculated by a formula $Z^2 \times P \times (1-P) / C^2$ and included as total 60 patients dividing into two groups (A or B) by envelop method. Anaesthesiologist who was blind to both groups conducted the study. Once the patient arrived the operation theatre intravenous fluid was started and basic monitors to record PR, ECG, MAP, SpO₂, ETCO₂ were attached. Group A patients were induced with Pethidine 1 mg/kg, Propofol 2.5 mg/kg and Vecuronium 0.1 mg/kg, group B patients were induced with similar dose of Pethidine and Propofol followed by Rocuronium 0.6 mg/kg after which mask ventilation was done for three minutes and trachea intubated. Maintenance of anaesthesia was done with 50% oxygen in air, Halothane 0.8-1% and intermittent positive pressure ventilation. Base line monitoring of PR, ECG, MAP, SpO₂, ETCO₂ was done and same parameters were noted one minute after the muscle relaxant, before intubation, one minute after intubation, before carboperitoneum, one minute after carboperitoneum, before skin incision, one minute after skin incision, before extubation and one minute after extubation. When the first twitch of TOF (Train of four) (T1) recovered 25% of the control (T4) or 75 % block remained still as shown by PNS (peripheral nerve stimulator) further increment of either Vecuronium 0.05 mg/kg or Rocuronium 0.15 mg/kg was done respectively. Intraoperatively whatever complications occurred were also recorded. After completion of surgery patients were reversed with Neostigmine 0.05 mg/kg and Atropine 0.02 mg/kg successively. Statistical analysis was done using programme SPSS (Statistical Package for Social Sciences) 19 version. Chi-square test, Fisher's exact test and Student's t test were used as appropriate and a p value <0.05 was taken as statistically significant.

RESULTS

The demographic parameters (age, weight, gender) were similar between two groups as shown in table 1. Similarly, respiratory parameters were similar in two groups as shown in table 2 and 3. Table 4 and 5 show haemodynamic parameters. While MAP is similar in two groups throughout surgery, there is a significant reduction in PR in Vecuronium group before and one minute after carboperitoneum creation.

Table 1: Patients profile in two groups.

Patient profile	Group A [Mean±SD]	Group B [Mean±SD]	P-Value
Age (years)	42.63±13.720	42.90±13.005	0.939
Weight (Kilograms)	53.40±6.755	52.93±5.521	0.771
Gender Ratio (male /female)	6/24	5/25	1.000

P-value calculated by Student "t" test for age, weight and Fisher's exact test for gender ratio.

Table 2: SpO₂ at different events in two study groups.

Time of recorded variable	Group A [Mean±SD]	Group B [Mean±SD]	P- Value
Baseline	96.567±1.6543	96.667±1.6470	0.815
1 minute after Muscle Relaxant	98.600±1.9226	99.233±1.0400	0.118
Before Intubation	98.833±1.8020	99.433±1.0063	0.117
1 minute after Intubation	99.100±1.4937	99.467±.9732	0.265
Before Skin Incision	99.267±1.5298	99.567±.5040	0.312
1 minute after Skin Incision	99.267±1.2847	99.567±.5040	0.239
Before carboperitoneum	99.667±.5467	99.533±.5074	0.332
1 minute after carboperitoneum	99.567±.5683	99.600±.4983	0.810
Before Extubation	99.567±.5683	99.567±.5040	1.000
1 minute after Extubation	99.567±.5683	99.567±.5040	1.000

P-value calculated by Student "t" test.

Table 3: ETCO₂ at different events in two study groups.

Time of recorded variable	Group A [Mean±SD]	Group B [Mean±SD]	P- Value
Baseline	28.400±3.9444	29.367±4.9094	0.404
1minute after Muscle Relaxant	28.267±3.9386	30.067±4.6233	0.110
Before Intubation	29.167±4.2676	30.967±4.0894	0.101
1minute after Intubation	30.833±3.5824	31.667±4.2291	0.414
Before Skin Incision	31.700±3.6022	32.067±3.8590	0.705
1minute after Skin Incision	32.233±3.4108	31.500±3.5792	0.420
Before carboperitoneum	32.033±4.1062	32.233±3.3185	0.836
1 minute after carboperitoneum	30.367±3.7827	32.500±2.9798	0.018
Before extubation	32.067±2.6644	32.200±3.1338	0.860
1 minute after extubation	32.467±2.8616	32.367±3.0792	0.897

P-value calculated by Student "t" test.

Table 4: MAP at different events in two study groups.

Time of recorded variable	Group A (Mean \pm SD)	Group B (Mean \pm SD)	P- Value
Baseline	94.23 \pm 20.759	85.70 \pm 19.309	0.105
1 minute after Muscle Relaxant	83.70 \pm 17.650	80.87 \pm 15.445	0.511
Before Intubation	82.57 \pm 16.792	82.60 \pm 14.479	0.993
1 minute after Intubation	99.50 \pm 19.251	104.03 \pm 16.121	0.327
Before Skin Incision	93.33 \pm 14.461	93.50 \pm 14.422	0.965
1 minute after Skin Incision	99.50 \pm 17.039	99.13 \pm 13.369	0.926
Before carboperitoneum	95.63 \pm 16.566	91.17 \pm 11.742	0.233
1 minute after carboperitoneum	92.80 \pm 24.800	88.43 \pm 13.873	0.403
Before Extubation	94.03 \pm 14.250	95.57 \pm 13.490	0.670
1 minute after Extubation	109.57 \pm 14.567	109.77 \pm 12.605	0.955

P-value calculated by Student "t" test.

Table 5: PR measured at different events in two study groups.

Time of recorded variable	Group A [Mean \pm SD]	Group B [Mean \pm SD]	P -Value
Base Line	81.133 \pm 16.0833	77.667 \pm 15.6212	0.401
1 minute after Muscle Relaxant	76.700 \pm 14.4034	81.167 \pm 15.6978	0.256
Before Intubation	73.867 \pm 14.5026	79.667 \pm 14.8285	0.131
1 minute after Intubation	90.90 \pm 14.805	90.77 \pm 14.029	0.972
Before Skin incision	82.40 \pm 12.260	84.87 \pm 13.480	0.461
1 minute after Skin incision	87.77 \pm 12.824	94.03 \pm 14.576	0.082
Before carboperitoneum	80.033 \pm 13.4202	89.500 \pm 13.6502	0.009
1 minute after carboperitoneum	62.800 \pm 11.2569	87.233 \pm 14.3591	0.000
Before Extubation	85.367 \pm 13.2989	86.233 \pm 13.7055	0.805
1 minute after Extubation	99.733 \pm 9.4975	100.000 \pm 13.3106	0.929

P-value calculated by Student "t" test.

Table 6: Complications between two study groups.

Complications	Group A	Group B	P value
Bradycardia	Present	12	<0.001
	Absent	18	
Asystole	Present	2	0.492
	Absent	28	

P-value calculated by Fisher's exact test.

DISCUSSION

From our study we found that after comparing Vecuronium or Rocuronium for laparoscopic cholecystectomy as muscle relaxants demographic profile was statistically insignificant with $p > 0.05$. Haemodynamic parameters showed significant PR change before and 1 minute after carboperitoneum in Vecuronium group than Rocuronium group where $P < 0.05$, MAP between two groups were statistically insignificant with $p > 0.05$. Similarly in respiratory parameters SpO_2 between two groups showed statistically insignificant value ($p > 0.05$) and $ETCO_2$ between two groups again showed statistically insignificant value with $p > 0.05$. In Vecuronium group, there was statistically significant number of cases of bradycardia requiring Atropine administration compared to Rocuronium group with $p < 0.05$ whereas asystole was statistically insignificant with $p > 0.05$.

Vecuronium and Rocuronium are both aminosteroid compounds having good neuromuscular blocking property but showing different cardiovascular effects. Vecuronium shows mild vagotonic activity whereas Rocuronium is mild vagolytic⁷. Booth MG et al compared haemodynamic property of Vecuronium and Rocuronium during Halothane anaesthesia in plastic surgery in 60 patients and found that PR increased in 36% cases in Rocuronium group than Vecuronium group⁸. Schramm WM et al studied effects of Vecuronium and Rocuronium on ICP (Intracranial pressure), MAP, PR in 20 neurosurgical patients and found that effect of single bolus dose of 0.6 mg/kg of Rocuronium or 0.1 mg/kg of Vecuronium was evaluated in patients receiving further continuous anaesthesia with Sufentanyl and Midazolam for 15 minutes where there was no rise of MAP in any groups whereas Rocuronium group showed increased PR in 4% cases⁹.

Robertson EN and colleagues did a comparative study of Rocuronium and Vecuronium on cardiovascular and intraocular pressure effects on 30 patients after induction with Propofol and Fentanyl. PR, MAP and IOP was measured and found that Rocuronium group showed rise in MAP by 10-15% and PR by 5-10%¹⁰. Shorten GD and colleagues compared haemodynamic effects after administration of Rocuronium 0.6 mg/kg or Vecuronium 0.1 mg/kg in 40 elderly patients for plastic surgery patients after equally dividing into two groups. General anaesthesia was given with Propofol, Pethidine and maintained with Oxygen, N_2O for burn graft. In all of them MAP, PR was measured 1 minute after induction, 1 minute after intubation. The measured values showed that MAP, PR were similar in two groups throughout the operation¹¹. Sanjula Virmini et al showed in their study that 60 patients undergoing elective cardiac valve surgery received Rocuronium 0.6 mg/kg or Vecuronium 0.1 mg/kg and Pancuronium 0.1 mg/kg then PR, MAP were compared. Intra operative results showed that Pancuronium increased PR by 10%¹². Harvey et al compared the PR during Gynaecological laparoscopic procedure with Rocuronium or Vecuronium in 116 patients and it seen that patients receiving Rocuronium had very few episodes of bradycardia (1%) than patients getting Vecuronium where incidence was more than five percent¹³.

CONCLUSION

Rocuronium is less likely to cause bradycardia as compared to Vecuronium in laparoscopic cholecystectomy while other haemodynamic parameters are similar among them.

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