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Original Research Article

# A Prospective Comparative Study of Recovery Characteristics and Hemodynamic Stability of Cisatracurium with Vecuronium

**Binal Patel[1], Mitali B Saraswala[2], Nidhi Patel[3], Vijalbahen K Patel[4]**

[1]MD Anesthesiology, Dept. of Anesthesiology, Government Medical College Surat, Gujarat

[2]Assistant Professor, Dept. of Anesthesiology, Government Medical College Surat, Gujarat

[3]Assistant Professor, Dept. of Anesthesiology, Government Medical College Surat, Gujarat

[4]Assistant Professor, Dept. of Anesthesiology, NAMO MERI, Silvassa

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**Corresponding author: Dr. Mitali B Saraswala**

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**Abstract**

The modern practice of anesthesiology relies on the use of combinations of intravenous and inhaled drugs to take advantage of the favorable properties of each agent while minimizing their adverse effects. The choice of anesthetic technique is determined by the type of diagnostic, therapeutic, or surgical intervention to be performed. As laparoscopic surgery cause more hemodynamic changes, Neuromuscular blocking agents with better hemodynamic stability and with predictable recovery is preferred. After approval from ethical committee, a prospective comparative study was conducted in tertiary care hospital. Comparison of hemodynamic stability and recovery characteristics between cisatracurium and vecuronium was done. After thorough preoperative evaluation and written informed consent, total 60 patients were scheduled for planned laparoscopic surgery. We concluded from our study that vecuronium and cisatracurium provides comparable intubating conditions, onset of time and hemodynamic stability. Recovery time from last supplemental dose to extubation time was shorter and positive clinical tests (head lift for 5 sec, effective hand grasp, visual disturbance, facial weakness)were noticed early (15 minutes after extubation) in most of the patients in cisatracurium group. Vecuronium showed significantly longer duration of action compared to cisatracurium. But, if recovery time is priority, cisatracurium is good alternative.

**Keywords :** Cisatracurium , Vecuronium, recovery characteristics, hemodynamic stability.



## Introduction

The neurophysiologic state produced by general anesthetics is characterized by five primary effects: unconsciousness, amnesia, analgesia, inhibition of autonomic reflexes, and skeletal muscle relaxation. The modern practice of anesthesiology relies on the use of combinations of intravenous and inhaled drugs (balanced anesthesia techniques) to take advantage of the favorable properties of each agent while minimizing their adverse effects.[1]The choice of anesthetic technique is determined by the type of

diagnostic, therapeutic, or surgical intervention to be performed. For minor superficial surgery or for invasive diagnostic procedures, oral or parenteral sedatives can be used called monitored anesthesia care techniques. For more extensive surgical procedures (e.g. body cavity is entered, organs are removed, mesenchymal barrier is opened), anesthesia may begin with preoperative premedication (e.g.benzodiazepines), be induced (e.g. thiopental or propofol), and be maintained with a combination of inhaled (e.g. volatile agents, nitrous oxide) or intravenous drugs (e.g. propofol, opioid analgesics), or both. These surgeries may require endotracheal intubation which is facilitated by administration of neuromuscular blocking agents (NMBAs).[1] A neuromuscular blocking agent should ideally have high potency, rapid onset, and short clinical duration. It should evade any hemodynamic changes due to histamine release, ganglion block, and anti- muscarinic actions. Usage of NMBAs improve intraoperative surgical and anesthetic conditions. NMBA are divide into two groups:

- Depolarizing NMBA: succinylcholine
- Non-depolarizing NMBA: vecuronium, pancuronium, rocuronium, mivacurium, cisatracurium, atracurium

Cisatracurium and Vecuronium are non-depolarizing NMBAs with an intermediate duration of action.

Vecuronium is steroidal compound and cisatracurium is benzylisoquinolinium. Metabolism of vecuronium is dependent on hepatic and renal function. [2]

In present era, laparoscopic surgery becomes more popular due to advantages in reduction of postoperative pain, better cosmetic results, quicker return to normal activities, reduction in hospital stay resulting in overall reduction in medical cost, less intraoperative bleeding, less postoperative pulmonary complications, less postoperative wound infection, reduced metabolic derangement, and better postoperative respiratory function. On the other hand, laparoscopy can compromise the cardiovascular and respiratory function of the patients.[3]

There is numerous major surgeries, abdominal surgery, thoracic surgery, head and neck surgery, which required intraoperative hemodynamic stability. But to maintain uniformity of the results, we decided to take laparoscopic surgery in our study. And we aimed to compare hemodynamic stability and recovery characteristics of cisatracurium(ED×3) and vecuronium (ED×2)in laparoscopic surgery.

As laparoscopic surgery cause more hemodynamic changes, NMBA with better hemodynamic stability and with predictable recovery is preferred.[3] Comparison of hemodynamic stability and recovery characteristics between cisatracurium and vecuronium.

## Primary Objectives:

1) To compare the duration of action of first loading dose (C- 0.15 mg/kg vs V- 0.1 mg/kg) to return of spontaneous respiration following maintenance doses, and last dose.
2) Comparison of recovery characteristics (such as head lift, hand lift, facial weakness, visual disturbances) 15 min after extubation.
3) To evaluate hemodynamic stability of cisatracurium and vecuroneum.

## Material and Methods

After approval from ethical committee, a prospective comparative study was conducted in tertiary care hospital. After thorough preoperative evaluation and written informed consent, total 60 patients scheduled for planned laparoscopic surgery.

## Inclusion Criteria:

- Age 18 - 50 years of both sexes
- Patient have BMI < 30
- American society of Anaesthesiologists grade I, II and III.
- Patients receiving general anaesthesia.

## Exclusion Criteria:

- Patient's refusal
- Patients with disorder of cardiovascular, hepatic, renal or neuromuscular system, pre-existing coagulation defect.
- Pregnant and lactating woman.
- Patients with airway problems suggesting difficult intubation.
- Patients with risk of regurgitation aspiration disease, full stomach, gastrointestinal reflex disease, hiatus hernia.
- Patients taking medication which have indirect or additive neuromuscular blocking properties.

A detailed pre-anesthetic checkup was done before surgery. During pre-anesthetic checkup detailed systemic examination and airway assessment done. At the end of checkup, eligible patients and their relatives were informed about our study and who gave informed written consent were included in study and explained about procedures. 60 patients according to American society of Anaesthesiology (ASA) class I, II and III between age groups of 18-50 years was planned for surgeries under General anesthesia such as laparoscopic hernioplasty, laparoscopic cholecystectomy, laparoscopic diagnostic hysteroscopy and laparoscopic appendicectomy was included in study. Surgeries with duration upto 180 minutes were included.

The consultant in charge of the patient had decided which muscle relaxant patient received (either vecuronium or cisatracurium).

Group V: vecuronium with initial dose of 0.1 mg/Kg (2×ED) and maintenance dose of 0.02 mg/Kg.

Group C: cisatracurium with initial dose of 0.15 mg/kg (3×ED) and maintenance dose of 0.03 mg/kg.

Patients was pre-medicated with,Inj. Glycopyrolate 0.2 mg (0.008 mg/kg) i.v, Inj. Midazolam 1 mg (0.02 mg/kg) i.v, Inj. Ondansetron 4 mg i.v, Inj. Tramadol 100 mg (2 mg/kg) i.v

All routine monitoring devices were attached (NIBP, pulse oximeter, ECG, ETCO2).

Patients were pre-oxygenated with 100% O2 by face mask for 3 minutes. Patients were induced with inj. Pentothal (7mg/kg). Cisatracurium/ vecuronium in above mentioned dosage was administered after onset of Pentothal action.(Loss of eyelsh reflex) Patient was ventilated for the next 3 minutes and subsequently intubated with proper sized cuffed ET tube. HR, SBP, MAP, and SPO2 were recorded just before intubation, then at 1 minute, 3 minute, 5 minute and for 10 minutes. And then every 10 minutes till end of surgery. Anaesthesia was maintained with O2+N2O+sevoflurane (1-2%) in a ratio of 1:2 and assisted ventilation. Extubation was done when adequate tidal volume, spontaneous eye opening present and sustained head/ hand/ leg lifting present for 5seconds and pharyngeal and laryngeal reflexes present. Patient was reversed with inj. Neostigmine (0.05mg/kg) + inj. Glycopyrolate (0.008 mg/kg) at the end of surgery. Time of last supplemental dose of relaxant to extubation was noted. 15 minutes after tracheal extubation, patients was examined for sign and symptoms of residual neuromuscular blockade:

1) Sustained head lift for 5 seconds
2) Hand lift for 5 seconds without assistance
3) Effective hand grip strength for 5 seconds

Patient was asked for presence or absence of following symptoms:

1) Visual disturbances (muddy vision/difficulty in focusing eyes) inadequacy of extra ocular muscle function.
2) Facial weakness (inability to smile)
3) Weakness of oral and pharyngeal muscles (difficulty in swallowing) and symptoms of generalised muscle weakness.

Patients were monitored for intra-operative complications like tachycardia (HR > 20% from baseline), bradycardia (HR < 20%

from baseline), Hypertension (BP > 20% from baseline), Hypotension (BP < 20% from baseline), Arrhythmia, Bronchospasm.Signs/ symptoms of histamine release: skin changes graded as erythema of the face, neck and upper torso, flush (if redness lasted > 120 s) or wheals and presence of any hemodynamic changes (hypotension and tachycardia) or bronchospasm were also monitored.

**Stastical Analysis**

1. Data was entered into Microsoft excel worksheet. Mean and SD were calculated using MS excel programme.
2. The analysis of the data was done with the help of open Epi software version 2.3.
3. All the above mentioned parameters and characteristics were compared using unpaired t-test and chi square test. If P< 0.05 was considered as statistically significant; whereas, P< 0.001 was considered as highly significant and P> 0.05 was regarded as statistically not significant.
4. To generate the graphs and tables, Microsoft Office 2010 (word and Excel) have been used.

**Result**

All patients consider in the study were aged between 18- 50 years in both groups. Mean of patient's age was 38.6 ± 10.2 years for group V and 35.4 ± 10.4 years for group C. 53.3% & 46.7% participants of group V and 46.7% & 53.3% of group C were male and female respectively.

Mean BMI of participants of group V and C was 21.7 ± 2.6 kg/mtr2 and 22.1 ± 2.7 kg/mtr2

All participants of group V and 93.3% & 6.7% of group C were belonged to ASA class II and III respectively.

**Table 1: Mean duration of surgery [N=60]**

| Mean duration of surgery [in min] | Group V [n=30] | Group C [n=30] | P value |
|---|---|---|---|
| Mean ± SD | 98.5 ± 37.1 | 81.9 ± 38.6 | >0.05 |

This table show the mean duration of surgery which was 98.5 ± 37.1 for group V and 81.9 ± 38.6 for group C. the difference was statistically not significant.

- 23 (76.67%) patients of group V, 22 (73.33%) patients of group C provided excellent intubating conditions. 7 (23.33%) of group V and 8 (26.66%) of group C provided good intubating conditions.

**Table 2: Mean duration of action [N=60]**

| Mean duration of action [in min] | Group V [n=30] | Group C [n=30] | P value |
|---|---|---|---|
| Mean ± SD | 53.4 ± 24.5 | 43.7 ± 13.8 | <0.05 |

It is time interval from the completion of the intravenous injection of the relaxant to spontaneous recovery (flicker on reservoir bag/ dip in capnograph waveform) of bolus dose. We observed that the mean clinical duration of action in group V and group C was 53.4 ± 24.5 minute and 43.7 ± 13.8 minute respectively. The difference between both the groups was statistically significant. The duration of action of vecuronium group was significantly longer than cisatracurium group.

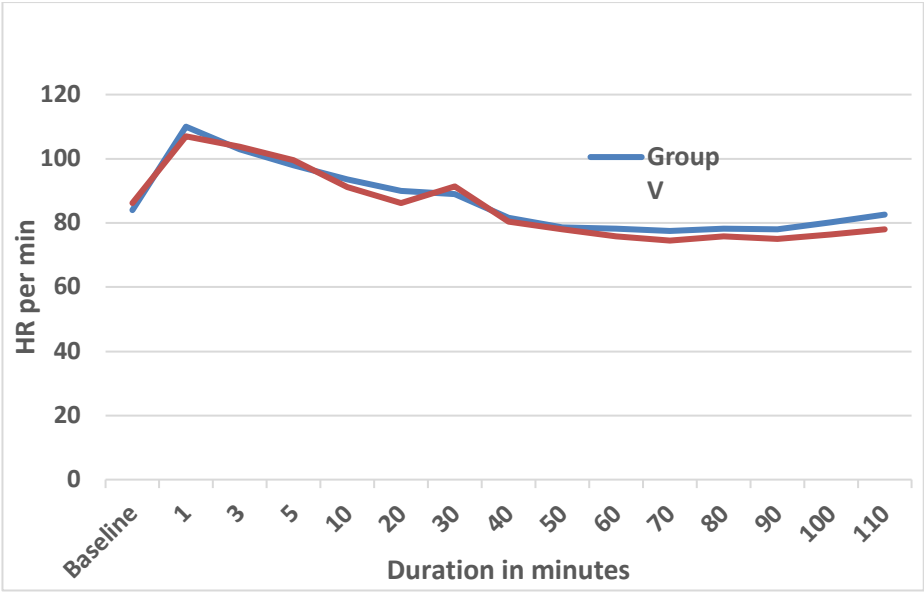


**Figure 1: Intra-Operative Mean Heart Rate**

This chart shows mean heart rate (per minute) recorded at base line pre-operatively, 1 minute, 3 minute, 5 minute, 10 minute after intubation and then after 10 min of interval up to end of the surgery. Change in pulse rate between both the groups was not significant throughout surgery.

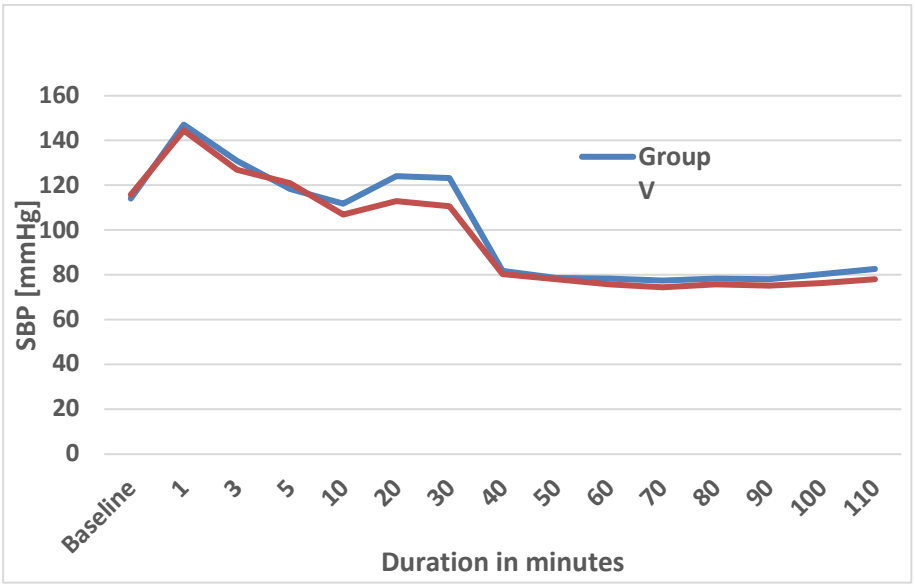


**Figure 2: Intra-Operative Mean SBP**

This chart shows mean systolic arterial blood pressure (mmHg) recorded at baseline pre-operatively,1 minute, 3 minute, 5 minute, 10 minute after intubation and then 10 minute interval up to end of the surgery. Throughout the surgery there were no significant difference in systolic blood pressure of both the drugs except, at 20 minutes mean systolic blood pressure for group V was 124± 14.7 mmHg, at 30 minutes 123.2±14.9 mmHg and in group C was 112.9±13.4 mmHg, 110.7± 16.7 respectively. Which was higher side in group V and this observation was statistically significant. (P value <0.05)

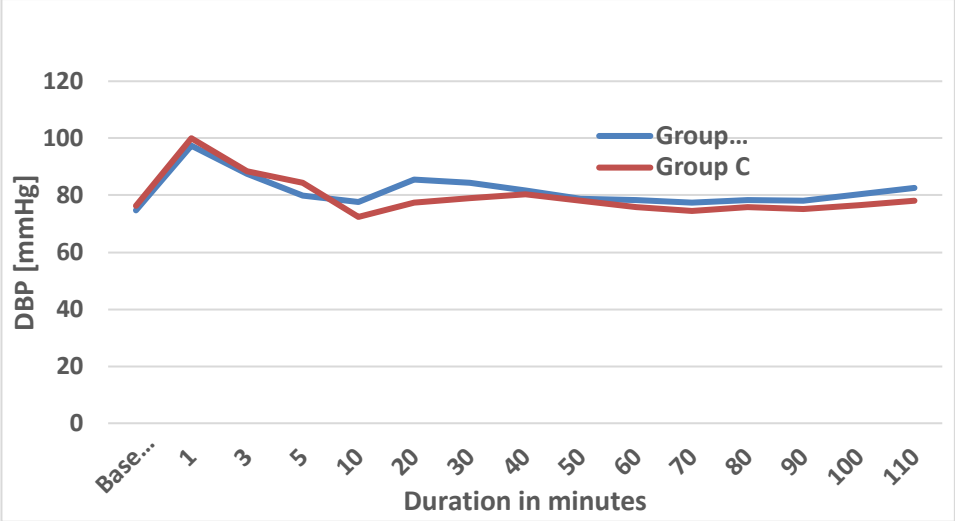


**Figure 3: Intra-Operative Mean DBP**

This chart shows mean diastolic arterial blood pressure (mmHg) recorded at baseline pre-operatively,1 minute, 3 minute, 5 minute, 10 minute after intubation and then 10 minute interval up to end of the surgery.Diastolic blood pressure was comparable throughout the surgery in both groups, except at 20 minutes mean diastolic blood pressure for group V was 85.4± 11.1 mmHg, at 30 minutes 84.4±11 mmHg and in group C was 77.3±10 mmHg, 78.9±11.5 and at the time of extubation 81.4±11.5 mmHg for group V and 87.3 ± 7.1 mmHg for group C respectively. Which was statistically significant. (P value <0.05)

**Table 3: Mean time of spontaneous respiration from last supplemental dose[N=60]**

| Mean time of spontaneous respiration [in min] | Group V [n=30] | Group C [n=30] | P value |
|---|---|---|---|
| Mean ± SD | 42.5 ± 26.7 | 35.7 ± 13.8 | >0.05 |

Table 3 shows that mean time of spontaneous respiration in group V and C was 42.5 ± 26.7 minutes and 35.7 ± 13.8 minutes respectively.We observed that group V takes longer time (42.5± 26.7) minutes to recover from neuromuscular blockade after last supplemental dose compared to group C (35.7± 13.8) minutes but the difference was not statistically significant. (P value >0.05)

**Table 4: mean of total recovery time [N=60]**

| Mean recovery time [min] | Group V [n=30] | Group C [n=30] | P value |
|---|---|---|---|
| **Mean±SD** | 59.51±26.94 | 46.93±13.42 | <0.05 |

We observed that group V takes longer time (59.5± 26.94) minutes to recover from neuromuscular blockade after last supplemental dose compared to group C (46.93± 13.42) minutes which was statistically significant.

**Table 5: Head lift [N=60]**

| Duration [in min] | Head Lift | | | | |
|---|---|---|---|---|---|
| | ≤ 5 sec | | >5 sec | | |
| | V | C | V | C | P value |
| 15 | 22 (73.3%) | 9 (30%) | 8 (26.6%) | 21 (70%) | <0.001 |

| | | | | | |
|---|---|---|---|---|---|
| 25 | 7 (23.3%) | 0 | 23 (76.67%) | 30 (100%) | <0.05 |
| 35 | 0 | 0 | 30 (100%) | 30 (100%) | |

This table shows ability to sustained head lifting for 5 seconds, 15 minutes after extubation, at 10 minutes of interval up to 35 minutes of extubation. We observed at 15 minute after extubation 21(70%) patients of group C and 8(26.6%) patients of group V were able to sustained head lifting for 5 seconds. The difference between group V and group C was highly statistically significant. At 25 minutes after extubation, all patients of group C (30, 100%) and 23 (76.67%) of group V were able to sustained head lifting for 5 seconds. This observation was statistically significant. At 35 minutes after extubation, all patients of both groups were able to perform head lifting satisfactorily.

**Table 6: Hand lift [N=60]**

| Duration [in min] | Hand Lift | | | | |
|---|---|---|---|---|---|
| | ≤ 5 sec | | >5 sec | | |
| | V | C | V | C | P value |
| 15 | 15 (50%) | 8 (26%) | 15 (50%) | 22 (73.3%) | >0.05 |
| 25 | 8 (26.67%) | 1(3.3%) | 22 (73.3%) | 29(96.6%) | >0.05 |
| 35 | 0 | 0 | 30(100%) | 30(100%) | |

This table shows ability to sustained hand lifting for 5 seconds, 15 minutes after extubation, at 10 minutes of interval up to 35 minutes of extubation. At 15 minutes after extubation 22(73.3%) patients of group C and 15(50%) patients of group V were able to hand lifting without assistance for 5 seconds. At 25 minutes after extubation 29(96.6%) patients of group C and 22(73.3%) of group V were able to hand lifting without assistance for 5 seconds. Both of these observations were statistically not significant (P> 0.05).At 35 minutes after extubation all patients of both groups were able to perform hand lift without assistance satisfactorily.

**Table 7: Hand grasp [N=60]**

| Duration [in min] | Hand Grasp | | | | |
|---|---|---|---|---|---|
| | ≤ 5 sec | | >5 sec | | |
| | V | C | V | C | P value* |
| 15 | 20(66.67%) | 4(13.33%) | 10(33.33%) | 26(86.7%) | <0.001 |
| 25 | 8(26.67%) | 0 | 22(73.3%) | 30(100%) | <0.05 |
| 35 | 0 | 0 | 30(100%) | 30(100%) | |

This table shows ability to hand grasping for 5 seconds, 15 minutes after extubation, at 10 minutes of interval up to 35 minutes of extubation. We observed, At 15 minute after extubation, 26(86.7%) patients of group C and 10(33.33%) patients of group V were able to perform hand grasp effectively. The difference between both groups was highly statistically significant. At 25 minutes after extubation, all patients of group C (30,100%) and 22 (73.3%) patients of group V were able to hand grasp effectively.Both of above observations were statistically significant. (P <0.05) At 35 minutes after extubation, all patients of both groups were able to perform hand grasping effectively.

**Table 8: Visual Disturbance [N=60]**

| Duration [in min] | Visual Disturbance | | | | |
|---|---|---|---|---|---|
| | Present | | Absent | | |
| | V | C | V | C | P value |
| 15 | 27(90%) | 16(53.3%) | 3(10%) | 14(46.7%) | <0.05 |
| 25 | 13(43.3%) | 4(13.3%) | 17(56.6%) | 26(86.7%) | <0.05 |
| 35 | 1(3.3%) | 0 | 29(96.7%) | 30(100%) | >0.05 |

This table shows visual disturbances like muddy vision, inadequacy of extra- ocular muscle function, 15 minutes after extubation, at 10 minutes of interval up to 35 minutes of extubation. At 15 minutes after extubation, 27(90%) patients of group V and 16(53.3%) patients of group C were experienced visual disturbances. At 25 minutes after extubation 13(43.3%) patients of group V and 4(13.3%) patients of group C experienced visual disturbances.Both of these observations were statistically significant. (P< 0.05) At 35 minutes after extubation, only 1 patient of group V and none of group C were experienced visual disturbances.

**Table 9: Facial Weakness [N=60]**

| Duration [in min] | Facial Weakness | | | | |
|---|---|---|---|---|---|
| | Present | | Absent | | |
| | V | C | V | C | P value* |
| 15 | 11(36.7%) | 2(6.67%) | 19(63.3%) | 28(93.3%) | <0.05 |
| 25 | 2(6.67%) | 1(3.33%) | 28(93.3%) | 29(96.7%) | >0.05 |
| 35 | 0 | 0 | 30(100%) | 30(100%) | |

This table shows facial weakness like difficulty to lough, facial numbness,15minutes after extubation, at 10 minutes of interval up to 35 minutes of extubation. At 15 minutes after extubation, 11(36.7%) patients of group V and 2 (6.67%) patients of group C experienced facial weakness. This observation was statistically significant. (P<0.05) At 25 minutes after extubation, 2(6.67%) patients of group V and 1 patient of group C experienced facial weakness. (P>0.05) At 35 minutes after extubation all patients were recovered from facial weakness.

**Table 10: Weakness of Oral & Pharyngeal Muscles [N=60]**

| Duration [in min] | Weakness of Oral & Pharyngeal Muscles | | | | |
|---|---|---|---|---|---|
| | Present | | Absent | | |
| | V | C | V | C | P value |
| 15 | 4(13.3%) | 1(3.3%) | 26(86.7%) | 29(96.7%) | 0.1613 |
| 25 | 1(3.3%) | 0 | 29(96.7%) | 30(100%) | 0.3153 |
| 35 | 0 | 0 | 30(100%) | 30(100%) | |

This table shows weakness of oral and pharyngeal muscles like swallowing, 15 minutes after extubation, at 10 minutes of interval up to 35 minutes of extubation. At 15 minutes after extubation, 4(13.3%) patients of group C and 1 (3.3%) patient of group C have difficulty in swallowing. This observation was statistically not significant.(P>0.05) At 25 minutes after extubation, only 1 patient of group V experienced difficulty in swallowing. (P>0.05) At 35 minutes after extubation, none of the patient had difficulty in swallowing from both the groups.

**Table 11: Intraoperative Complication [N=60]**

| Complications | Group V | Group C |
|---|---|---|
| Tachycardia (>20% from baseline) | 6 (20%) | 5 (16.67%) |
| Bradycardia (< 20% from baseline) | No | No |
| Hypertension (> 20% from baseline) | 14 (46.7%) | 8 (26.5%) |
| Arrhythmia | No | No |
| Bronchospasm | No | No |

Hypertension was noted in 14(46.7%) patients of group V and 8(26.5%) patients of group C and tachycardia noted in 6 (20%) patients of group V and 8(26.5%) patients of group C. No signs/ symptoms of histamine release (erythema of the face, neck and upper torso, decrease in blood pressure and tachycardia) noted. No any complication were noted in postoperative period.

## Discussion

The widespread use of neuromuscular blocking agents (NMBA) was a significant milestone in the development of anaesthesia. Before the introduction of NMBA, anaesthesia was induced and maintained with intravenous and inhalational anaesthesia. It is important for health system to be able to provide safe and efficient anaesthesia for a wide range of surgical procedures in children and adult. Neuromuscular blocking agents (NMBAs) are commonly used as a part of balanced anaesthetic technique to facilitate tracheal intubation and improve surgical conditions. MNBAs may decrease the incidence of hoarseness and vocal cord injuries during intubation, and can facilitate mechanical ventilation in patients with poor lung compliance.The most important aspect of a general anaesthetic technique is its ability to consistently achieve rapid recovery to patients' normal functioning after termination of surgery. C. Melloni et al (2006) [10] compared cisatracurium versus vecuronium as a comparative, double blind, randomized, multicenter study in adult patients under propofol/ fentanyl/ N2O anaesthesia. In our study, due to surgical issues laparoscopic surgery converted into open surgery; out of 63 patients 1 patient of cisatracurium group and 2 patients of vecuronium group had converted into the open surgery. So, here we conducted study in 60 patients. In our study we observed that both drugs provide similar intubating conditions. In vecuronium group out of 30, 23 (76.77%) patients observed excellent condition and in 7 (23.33%) good condition. In cisatracurium group out of 30, 22(73.33%) observe excellent condition while 8(26.66%) patient gave good condition. A.M. El-kasaby et al (2010)[4] compare cisatracurium in different doses versus atracurium during general anaesthesia for abdominal surgery. They reported that only 6× ED dose of cisatracurium was statistically significant versus the atracurium dose(2×ED) with higher percentages of patients with excellent condition of intubation. 4×ED and 6×ED dose of cisatracurium were significantly better than 2×ED dose of cisatracurium. Mrunalini Parasa et al (2015) [5]compare equipotent doses of rocuronium and vecuronium. They reported that overall intubation condition were excellent in 100% of group rocuronium and in group vecuronium there were 70% excellent, 23% good, 7% fair according to cooper scale of intubating conditions. Dr. S. Niranjana et al (2020) [8]compare efficacy of atracurium (0.5 mg/kg) and cisatracurium (0.3 mg/kg) in patients undergoing abdominal surgeries under general anaesthesia.They observed excellent intubating conditions in 46.7% and 83.3% of patients in group A and group C respectively. Good intubating conditions were observed in 50% and 16.7% of patients in group A and C respectively. Poor intubating conditions were noted in one patient in group A and none in group C.

D. M. Maybauer et al (2007)[9] conducted incidence and duration of residual paralysis at the end of surgery after multiple administrations of cisatracuirium and rocuronium. They reported that after repeated administration, the duration of action and its variability are greater with rocuronium than with cisatracurium.

Baseline pulse & BP were noted in preoperative recovery room. Intra-operatively pulse and BP were noted at 1,3,5 and 10 minutes and then every 10 minutes throughout the surgery. In our study when compared intraoperative pulse reading between group V and group C there was no significant difference in both groups. ($p > 0.05$). When intraoperative mean SBP, mean DBP and mean MBP readings were compared between both groups,after intubation there was increase in mean arterial pressure in both groups but the rise was comparable( $p>0.05$) except 20 and 30 min the mean arterial pressure was less in group C than group V. the fall was statistically significant( $p<0.05$). Keles GT et al (2004)[6] conducted a study for assessment of neuromuscular and haemodynamic effects of cisatracurium and vecuronium under sevoflurane-remifentanil anaesthesia in elderly patients. They reported that rocuronium, vecuronium and cisatracurium had no significant effects on the heart rate or blood pressure. Clinical duration of action is the time interval from the completion of the intravenous injection of the relaxant to spontaneous recovery of T1 to 25% of the control value. In our study, the clinical duration following group V (53.4±24.4 min) was longer than group C (43.7±13.8 min), it was statistically significant. ($P<0.05$). But, we observed higher variability in time to achieve spontaneous respiration in group V. Puhringer FK et al (2002) conducted a study on double blind, comparision of the variability in spontaneous recovery of cisatracurium and vecuronium induced neuromuscular block in adult and elderly patients. They reported that the duration of action of cisatracurium and its variability are significantly lower compared with vecuronium.In our study we compare time from last supplemental dose to return of spontaneous respiration. (Flicker on the bag/ dip seen in capnograph)Mean time of spontaneous respiration after last supplemental dose was longer for group V (42.5±26.7) compared to group C (35.7±13.8) which was statistically not significant.We observed that recovery after repeated doses of vecuronium was slower than cisatracurium. Group V have longer duration for return of spontaneous respiration to extubation. Which was 16.9±5.7 min for group V and 11.2±4.07min for group C. but this difference was statistically not significant. We observed that group V takes longer time (59.5± 26.94) to recover from neuromuscular blockade (extubation) after last supplemental dose compared to group C (46.93± 13.42) which was statistically significant. ($P <0.05$) Erkola O et al hypothesized that vecuronium affect the prejunctional receptor to a greater degree and this was an additional factor in prolonging recovery of the TOF ratio after repeated doses of the drug. M. T. Carroll et al (1998) compare the neuromuscular blocking effects and reversibility of cisatracurium and cisatracurium (0.1 mg/kg, 015 mg/kg) than atracurium (0.5 mg/kg).They recorded recovery time for atracurium (47-48 min) was shorter compare to cisatracurium (51-59 min, 45-48 min respectively). Cisatracurium (C) appeared safe and efficacious under the condition of study. We observed at 15 minute after extubation, 21(70%) patients of group C and 8(26.6%) patients of group V were able to sustained head lifting for 5 seconds and at 25 minutes after extubation, all patients of group C (30, 100%) and 23 (76.67%) of group V were able to sustained head lifting for 5 seconds. These both observations were statistically significant. At 15 minute after extubation, 26(86.7%) patients of group C and 10(33.33%) patients of group V were able to perform

hand grasp effectively and at 25 minutes after extubation, all patients of group C (30,100%) and 22 (73.3%) patients of group V were able to hand grasp effectively.Both of above observations were statistically significant. (P <0.05) At 15 minutes after extubation, 27(90%) patients of group V and 16(53.3%) patients of group C were experienced visual disturbances and at 25 minutes after extubation 13(43.3%) patients of group V and 4(13.3%) patients of group C experienced visual disturbances.Both of these observations were statistically significant. (P< 0.05) At 15 minutes after extubation, 11(36.7%) patients of group V and 2 (6.67%) patients of group C experienced facial weakness. This observation was statistically significant. (P<0.05) and at 25 minutes after extubation, 2(6.67%) patients of group V and 1 patient of group C experienced facial weakness. (P>0.05). Cammu G et al (2002)[7] conducted study a postoperative residual curarization with cisatracurium and rocuronium infusions. They recorded that patients receiving a cisatracurium or rocuronium infusion have a high incidence of postoperative residual curarization when the block is not antagonized. When reversal is not attemted, cisatracurium seems to be safer than rocuronium group.

In our study we compared recovery from cisatracurium and vecuronium by using clinical tests 1) sustained head lifting for 5 seconds, 2) hand lifting without assistance for 5 seconds, 3) hand grip strength for 5 seconds, 4) visual disturbances (muddy vision/ difficulty in focusing eyes, inadequacy of extra-ocular muscle function), 5) facial weakness (inability to smile), 6) weakness of oral and pharyngeal muscles (difficulty in swallowing).

Observation from our study suggests, in cisatracurium group more patients show adequate muscle strength at 15 minutes and 25 minutes after extubation than in vecuronium group when tested by, sustained head lifting for 5 seconds, hand grip strength for 5 seconds, visual disturbances (muddy vision/ difficulty in focusing eyes, inadequacy of extra-ocular muscle function), facial weakness (inability to smile).

Though, the sensitivity of clinical tests, sustain head lifting for 5 seconds (0.19), sustain hand grip for 5 seconds (0.18), facial weakness (inability to smile) (0.29), oropharyngeal weakness (inability to swallow) (0.21) is low as mentioned by cammu G, De witte j, De veylder j, et al. the combined quantitative assessment of neuromuscular blockade by TOF ratio can give actual status of recovery from neuromuscular blocking agent.

In our study, we reversed neuromuscular blockade with inj. Neostigmine (0.05 mg/kg) and inj. Glycopyrolate (0.008 mg/kg) i.v to avoid post-operative curarization.

**Adverse effect:**

In our study, there were no sign of anaphylaxis during anaesthesia. Two categories of potential complications related to the use of neuromuscular blockers can be identified: Adverse effects that are undesirable under any circumstances (e.g. histamine release, anaphylactoid or anaphylactic reaction) Adverse reactions caused by increased effect (e.g. improper dosage) and/or by incorrect timing (e.g. post-operative curarization). Briassoulis G et al (2000)observed persistent anaphylactic reaction after induction with thiopentone and cisatracuriunm. Bischoff A et al (2001) observed anaphylactoid reactions after cisatracurium administration in six patients. Observed that there was 14 (46.7%) of group V and 8 (26.6%) of group C require treatment with inj. Fentanyl or increased concentration of sevoflurane in both groups (p >0.05). so intraoperative management was comparable in both groups.

**Conclusion**

Thus, we concluded from our study that 2×ED95 dose of vecuronium (0.1 mg/kg) and 3×ED95 dose (0.15 mg/kg) of cisatracurium provides comparable intubating conditions, onset of time and hemodynamic stability. Recovery time from last supplemental dose to extubation time was shorter andpositive clinical tests (head lift for 5 sec, effective hand grasp, visual disturbance, facial weakness)were noticed early (15 minutes after extubation) in most of the patients in cisatracurium group. Vecuronium showed significantly longer duration of action compared to cisatracurium. But, if recovery time is priority, cisatracurium is good alternative.

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