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Reduced-dose rocuronium for day-case tonsillectomy in children where volatile anaesthetics are not used: operating room time saving

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Summary

Objectives: Mivacurium, rocuronium, and vecuronium are neuromuscular blocking agents (NMB) commonly used in pediatric day-case anesthesia. Mivacurium is the most appropriate NMB for short surgical procedures where NMB drugs were required but is not available in all countries.

Aim: We evaluated the operating room time minimization after reduced-dose rocuronium (0.45 $mg{\cdot}kg^{-1}$) during elective day-case tonsillectomy in children.

Methods/Materials: One hundred and five children (6–9 years, ASA I/II status) scheduled for day-case tonsillectomy were included in prospective, double blind clinical study. Children were randomly divided in three equal groups. All children were premedicated (midazolam 0.25 $mg{\cdot}kg^{-1}$ orally, EMLA). Anesthesia was induced (2.5 $mg{\cdot}kg^{-1}$) and maintained (0.1 $mg{\cdot}kg^{-1}{\cdot}min^{-2}$) by propofol and alfentanil (0.0015 $mg{\cdot}kg^{-1}{\cdot}min^{-1}$) and supplemented by inhalation mixture of 50% of O2/Air. Neuromuscular block was achieved by vecuronium (0.1 $mg{\cdot}kg^{-1}$) (*V*) or rocuronium in standard (0.6 $mg{\cdot}kg^{-1}$) (*R*) or reduced dose (0.45 $mg{\cdot}kg^{-1}$) (LD). Neuromuscular transmission was monitored by acceleromyography. Time analysis of NMB drugs action was performed.

Results: Time difference from the end of tonsillectomy to T90 neuromuscular block recovery was significantly shorter in LD Group (7.3 ± 0.41 min), (V = 15.9 ± 1.06, R = 16.0 ± 1.7 min) (P = 0.0011). The onset time of neuromuscular block was prolonged in LD Group (LD=3.1 ± 0.4, R = 1.3 ± 0.4, V = 2.2 ± 0.2 min) (P = 0.0039) without changing the intubating conditions. The maximum operation room time saving per each tonsillectomy was 37% in LD Group (Group V 21%, Group R 17%) (P = 0.0001). Low incidence of postoperative nausea and vomiting (PONV) 3–6% (0.4577) and good visual analog scale (VAS) score (≤2) (0.5969) were found in all study groups 12 h after surgery.

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Conclusions: Reduced-dose rocuronium in addition with propofol and alfentanil in children where volatile anesthetics are not used effectively saves the operating room time during short elective surgical procedures, avoids delays in patient recovery, allows high level of acceptable intubating conditions, and improves the optimal surgical work. Low incidences of PONV as VAS score may achieved successfully.

Keywords: anesthetics; ambulatory surgical procedures; children; intravenous; neuromuscular nondepolarizing agents; otorhinolaryngologic surgical procedures; propofol; rocuronium; tonsillectomy

Introduction

Tonsillectomy in children is one of elective, short surgical procedure under general anesthesia that may be performed on day-case basis. The quality choice of anesthetic agent and technique is essential for achieving the optimal surgical work and providing the safe and fast recovery with minimal postoperative morbidity (1).

Tracheal intubations of healthy pediatric patient some authors perform without muscle relaxants (2). In cases where volatile anesthetics are not used and short surgery procedure with neuromuscular relaxation is expecting, short- or intermediate-acting neuromuscular blocking agents (NMB) are usually used. The choice of nondepolarizing NMB drug is of the essential priority in consideration of the intense neuromuscular block until completion of the surgical work and short, complete recovery of neuromuscular function immediately after the end of the procedure. Mivacurium is a short-acting, recently the most optimal NMB agent for day-case surgery but often not available in many countries (3). Using intermediate-acting muscle relaxants results in unduly prolonged recovery time and the need for reversal drugs (4). Rocuronium bromide is an intermediate-acting NMB drug with short onset time of neuromuscular block (5,6). Reduced-dose of rocuronium bromide has been tested on pharmacodynamics and intubating conditions in different ways as reported by many authors (7–10). Perioperative time saving is still the matter of interest for day-case tonsillectomy in children where reduced-dose rocuronium is used.

The aim of this study was to evaluate the perioperative time minimization with reduced-dose rocuronium (1.5 × ED95; 0.45 $mg{\cdot}kg^{-1}$) during propofol/alfentanil anesthesia for short, elective day-case tonsillectomy in children when mivacurium is not available.

Materials and methods

One hundred and five children were analysed after prospective, double-blinded clinical study. A computer-generated random number randomized the children into three groups. Neuromuscular block was achieved by $2 \times ED_{95}$ of vecuronium (0.1 $mg{\cdot}kg^{-1}$) (Group V) and rocuronium in standard (0.6 $mg{\cdot}kg^{-1}$) (Group R) or reduced dose ($1.5 \times ED_{50}$; 0.45 $mg{\cdot}kg^{-1}$) (Group LD). The study started with positive decision of the Ethics Committee (Merkur University Hospital, Zagreb, Croatia). Only children with parent's written informed consent were included in the study.

The children of both gender and ASA I/II status between 6–9 years, were scheduled for tonsillectomy under general anesthesia. Exclusion criteria made known hypersensitivity to vecuronium or rocuronium bromide, difficult upper airways approach and/or difficult intubation, 20% deviation from ideal child body weight, neuromuscular and metabolic diseases, impaired kidney or liver function, and children who need to receive antibiotics that effect NMB. Children who need repeated dose of NMB under regular or prolonged tonsillectomy time (≥25 min) were excluded from the study.

All children were premedicated with midazolam (0.25 $mg{\cdot}kg^{-1}$ orally) 45 min prior to anesthesia induction. EMLA (5% eutectic mixture of lidocain and prilocaine) was placed over a peripheral vein.

Heart rate (HR), mean arterial pressure, peripheral hemoglobin saturation (SpO_2), and end-tidal carbon dioxide were measured noninvasively. The temperature was measured over the adductor pollicis muscle and maintained between 36 and 37.5°C to prevent the influence of hypothermia on the duration of neuromuscular (NM) blockade. Induction in anesthesia was performed with bolus dose of 2.0 propofol·mg·kg^{-1} preceded by 0.02 mg·kg^{-1} of alfentanil. Anesthesia was maintained with continuous infusion of propofol (0.1 mg·kg^{-1}·min^{-2}) and alfentanil (0.0015 mg kg^{-1}·min^{-2}) started immediately after induction to maintain systolic blood pressure and heart rate within 10–15% of the baseline. NSAID (diclofenac-Na, 1.0 mg·kg^{-1}) was given as one single dose rectally for early postoperative analgesia, immediately after induction of anesthesia and before application of NMB drug and intubations.

Monitoring of neuromuscular transmission was started immediately after loss of eyelash reflex by means of acceleromyography (TOF-Watch, Organon Teknika, the Netherlands). Supramaximal stimulation of the ulnar nerve was achieved at the wrist by surface electrodes. Once the patient was unconscious, control twitch height value of 100% (1 Hz frequency, 30mA) was established (T1). The muscle acceleration was measured by transducer fixed on the thumb. Train-of-four stimulation (TOF) was delivered every 15 s. Nondepolarizing neuromuscular block drug (NMB) was given by an independent anesthetist in the unlabeled syringe as 5 ml solution of appropriate NMB drug dose.

Anesthesiologist who was not involved in the study performed endotracheal intubation at maximal depression of the first twitch (T0). Intubating conditions were evaluated as excellent (jaw relaxed, vocal cords abducted and immobile, no diaphragmatic movement), good (some diaphragmatic movement), poor (vocal cords moving, coughing or bucking), and inadequate (jaw not relaxed and vocal cords closed). Clinically «acceptable» (excellent and good) or «unacceptable» (poor and inadequate) intubating conditions were considered according to consensus conference criteria (11).

The controlled mechanical ventilation was established after intubation. The inhalation gas mixture contained 50% of air in oxygen. The end-tidal CO_2 was maintained between 4.6 and 6.0 kPa. Additional dose of NMB drug (vecuronium 0.04 mg·kg^{-1}, rocuronium 0.15 mg·kg^{-1}) was applied if twitch height increased more than 10% during the surgical procedure.

The infusion of alfentanil was stopped when haemostasis was finished. Bought consular fosses were compressed with small, dumpling gauze wetted with 2 ml of 0.25% levibupivacaine. Continuous infusion of propofol was discontinued immediately before extubation. Reversion of neuromuscular block was performed in all children at the end of surgery. The optimum time to give reversal drugs (atropine 0.01 mg·kg^{-1}, neostigmine 0.02 mg·kg^{-1}) was when control twitch recovered ≥25% (T25) and four twitches were presented. Most of children at that time already had first slow diaphragmatic movements. Children were ventilated with 100% oxygen and extubated at 90% TOF control twitch high recovery. The extubation was performed when child achieved good respiration with 8–10 breaths·min^{-1}, maintained end-tidal CO_2 under 6 kPa and was responsive to verbal commands. Dumpling gauze wetted with 2 ml of 0.25% levibupivacaine was removed from bought tonsillar fosses immediately before extubation. Children were scored for clinical anesthesia recovery using the Steward-score point system with wakefulness (0- not responding, 1- responding to stimuli, 2- fully awake), ventilation (0- airway requires maintenance, 1- maintaining good airway, 2- coughing on command), and movement (1- not moving, 2- nonpurposeful movements, 3- moves purposefully) as assessed parameters. Children were discharged from operating room when coughing on command and were fully awake with purposeful movements (Steward-scoring points ≥5) (12). Postoperative nausea and vomiting (PONV) were noted postoperatively during first 6 h . Metoclopramide 0.15 mg·kg^{-1} i.v. was given only in children in whom nausea and/or vomiting persisted 1 h after anesthesia. Operating room time minimization, between three study groups, was concentrated on mean time differences between the end of surgery and child extubation (T90-Op; Op = mean duration of surgery, T90 = recovery time of neuromuscular block between the end of NMB drug application to recovery T1 to 90% of control twitch high) (min). All children left the operating room

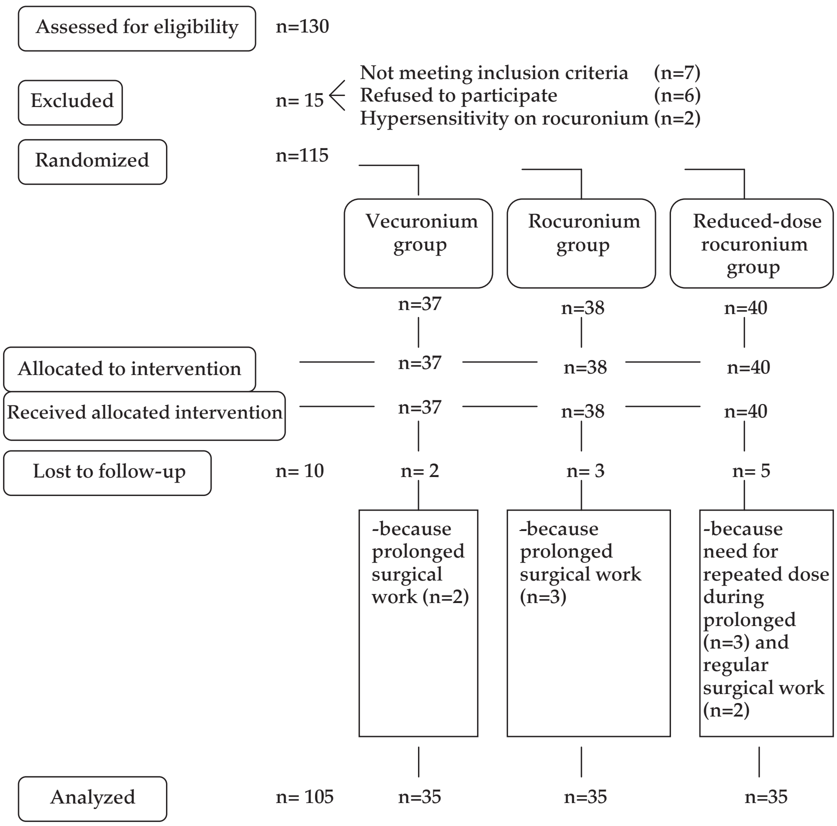

Table 1
Flow diagram of children distributions in study creation

immediately after extubation and were under surveillance in recovery room to observe acute pain by visual analog scale (VAS score) and PONV during 12 h after tonsillectomy.

Statistics

The sample size was calculated by 85% power of the study. Thirty-five children per group would require to detect the minimal recovery time difference of 30% between study groups with confidence <0.01. SPSS 11.0 (SPSS Inc., Chicago, IL, USA) statistical program was used. Quantitative data were expressed as means and their standard deviation (SD). One-way analysis of variance (ANOVA) with Post hoc test, if required, was performed to compare differences between groups. Mann–Whitney *U*-test was used for continuous variable with repeated measures. Qualitative data were presented as number (*n*) and percentage (%) and analyzed by Chi-Square test. *P* value <0.05 was considered as the minimum level of statistical significance.

Results

One hundred and thirty children were primarily enrolled in this study. Twenty-five of them were not included in the final analysis. Fifteen children were excluded before, four children had more than 20% deviation from ideal child body weight, three children assessed difficult airway preoperatively, six parents refused to participate, and two children had hypersensitivity on rocuronium and 10 after randomization (eight and two children needed repeated dose during prolonged and regular surgical work, respectively) (Table 1).

Three study groups were comparable according to age, weight, height, gender, ASA physical status, and intubating conditions. The incidence of PONV in children who were included in our study was 3–6% and did not significantly differ between the groups (0.4577) (Figure 1). VAS score ≤2 was found in high percentages in all study groups during 12 h after surgery (Group V 88%, R 83% and LD 86%)(0.5969) (Table 2).

Table 2
Demographic and procedural date

Variable	*Vecuronium (V)* 0.1 mg·kg^{-1} *N* = 35	*Rocuronium (R)* 0.6 mg·kg^{-1} *N* = 35	*Reduced-dose rocuronium (LD) 0.45 mg·kg^{-1} N* = 35	P *value*
Age (year)	7.20 ± 0.58 (6.9–7.4)	7.26 ± 0.78 (6.9–7.5)	7.23 ± 0.55 (7.0–7.4)	0.9272[a]
Weight (kg)	22.4 ± 1.79 (21.8–23.0)	22.8 ± 1.97 (22.1–23.5)	22.6 ± 2.53 (21.7–23.5)	0.7331[a]
Height (cm)	112 ± 2.80 (111–113)	112 ± 3.64 (110–113)	113 ± 3.51 (112–114)	0.3545[a]
Sex				
Female	19 (54%)	18 (51%)	19 (54%)	0.8865[b]
Male	16 (46%)	17 (49%)	16 (46%)	
ASA physical status				
I	28 (80%)	29 (83%)	29 (83%)	0.8159[b]
II	7 (20%)	6 (17%)	6 (17%)	
Intubating conditions				
Acceptable	34 (97%)	34 (97%)	34 (97%)	0.1466[b]
Unacceptable	1 (3%)	1 (3%)	1 (3%)	
Duration of surgery (Op) (min)	20.1 ± 1.33 (19.7–20.6)	20.3 ± 1.49 (19.8–20.8)	19.9 ± 1.43 (19.4–20.4)	0.5009[a]
PONV (<12 h postoperatively)	2 (6%)	1 (3%)	1 (3%)	0.4577[b]
VAS score (during 12 h postoperatively) ≤ 2	31 (88%)	29 (83%)	30 (86%)	0.5969[b]

[a]One-way analysis of variance (ANOVA). [b]Chi-Square test. Values are mean ± standard deviation (95% confidence interval for difference) or *n* (%). *P* value <0.05 was accepted as statistical significant difference compared to other groups. PONV, postoperative nausea and vomiting; VAS, visual analog scale.

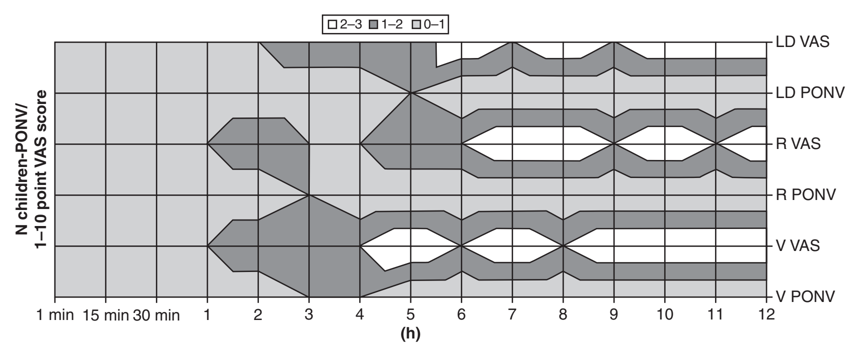

Figure 1
Postoperative nausea and vomiting (PONV) and visual analog scale (VAS) score during 12 h after adenotonsillectomy in children.

Acceptable intubating conditions were present in 97% in all groups (Group V: excellent 26, good 7, poor 1; Group R: excellent 29, good 4, poor 1; Group LD: excellent 19, good 14, poor 1). Slight diaphragmatic movements were the most often reason for good and moving vocal cords for poor intubation conditions in all children. No child had inadequate intubation conditions. The ratio of acceptable and unacceptable intubating conditions was without statistical significance between groups.

Mean duration of tonsillectomy in our study groups was 20 min (Group V 20.1 ± 1.33, Group R 20.3 ± 1.49, Group LD 19.9 ± 1.43 min) (P = 0.5009) (Table 2).

The onset time of neuromuscular block (T_0), the time between the end of injection and maximum depression of the first twitch (T_1), was significantly longer after reduced dose (3.1 ± 0.3 4 min) than standard dose of rocuronium (1.4 ± 0.17 min) (P = 0.0011) and vecuronium (2.2 ± 0.15 min) (P = 0.0039) (Table 3).

With reduced-dose rocuronium time to T_{25} (18.6 ± 0.47 min) was significantly shorter than in Group V (24.8 ± 0.96) and R (25.1 ± 0.26) (P = 0.0006) and also almost equal to the length of the surgical procedure (19.9 ± 1.43 min) (Figure 2). Children in LD Group had the fastest recovery of neuromuscular block to T90 (90% of control twitch high) 27.2 ± 0.86 min (Group V 36.0 ± 0.84, Group R 36.3 ± 0.53 min) (P = 0.0004) with 6 points of Steward score at this time (Figure 2).

Table 3
Pharmacodynamic variables following the dose of neuromuscular blocking agents NMBs (*V*, Vecuronium, 0.1 mg kg^{-1}; *R*, Rocuronium, 0.6 mg·kg^{-1}; LD, Reduced-dose rocuronium, 0.45 mg·kg^{-1})

	V (*N* = 35)	*R* (*N* = 35)	*LD* (*N* = 35)	*P* value[a]
Mesured[b]				
T_0	2.2 ± 0.15[c]	1.4 ± 0.17[c]	3.1 ± 0.34[c]	<0.005
T_{25}	24.8 ± 0.96	25.1 ± 0.26	18.6 ± 0.47[c]	0.0006
T_{75}	30.7 ± 0.95	31.0 ± 0.65	22.5 ± 0.71[c]	0.0005
T_{90}	36.0 ± 0.84	36.3 ± 0.53	27.2 ± 0.86[c]	0.0004
Calculated[d]				
$T_{25}–T_0$	22.6 ± 2.66	23.6 ± 2.12	15.4 ± 0.49[c]	0.0033
$T_{75–25}$	5.9 ± 0.39	5.9 ± 0.32	3.9 ± 0.21[c]	0.0014
$T_{90–75}$	5.3 ± 0.35	5.3 ± 0.37	4.7 ± 0.39[c]	0.0213
T_{90}–Op	15.9 ± 1.06	16.0 ± 1.70	7.3 ± 0.41[c]	0.0011

Values are mean ± standard deviation. [a]One-way analysis of variance (ANOVA) with Post hoc test. [b]T_o, onset time, time between the end of injection and maximum depression of T1; T25, duration of neuromuscular block, time between the end of injection and recovery T1 to 25% of control twitch; T75, T90, recovery of neuromuscular block, interval between the end of injection and recovery T1 to 75%, and to 90% of control twitch. [c]$P < 0.05$ statistical significancy versus all other groups. [d]T25–T_o, clinical duration, time difference in duration of neuromuscular block between T25% and To; RI, recovery index, recovery of T1 from 25% to 75% of control twitch; T90–T75, recovery time, time difference in recovery of neuromuscular block between T90 and T75.

The shortest time from the end of surgery to complete recovery of neuromuscular function (T_{90}-Op) was with reduced-dose rocuronium (7.3 ± 0.41 min) (P = 0.0011) (Group V: 15.9 ± 1.06 min and Group R (16.0 ± 1.7 min) (P = 7.5720) (Figure 3). Following this, the maximum operation room time saving per each tonsillectomy time in our study groups was 37% with reduced dose rocuronium (Group V 21%, Group R 17%)(P = 0.0001).

Discussion

The present study demonstrated that single reduced-dose rocuronium (0.45 mg·kg^{-1} min^{-1}) may provide operating room time minimization of 37% in short, elective tonsillectomy in children. It is also the optimal dose for ENT surgery in children in view of shorter clinical duration and faster recovery of NMB with appropriate deep of neuromuscular block during the surgery were maintained dose of NMB drug was not required.

Few special circumstances originated from our data when using reduced-dose rocuronium in day-case ENT surgery in children.

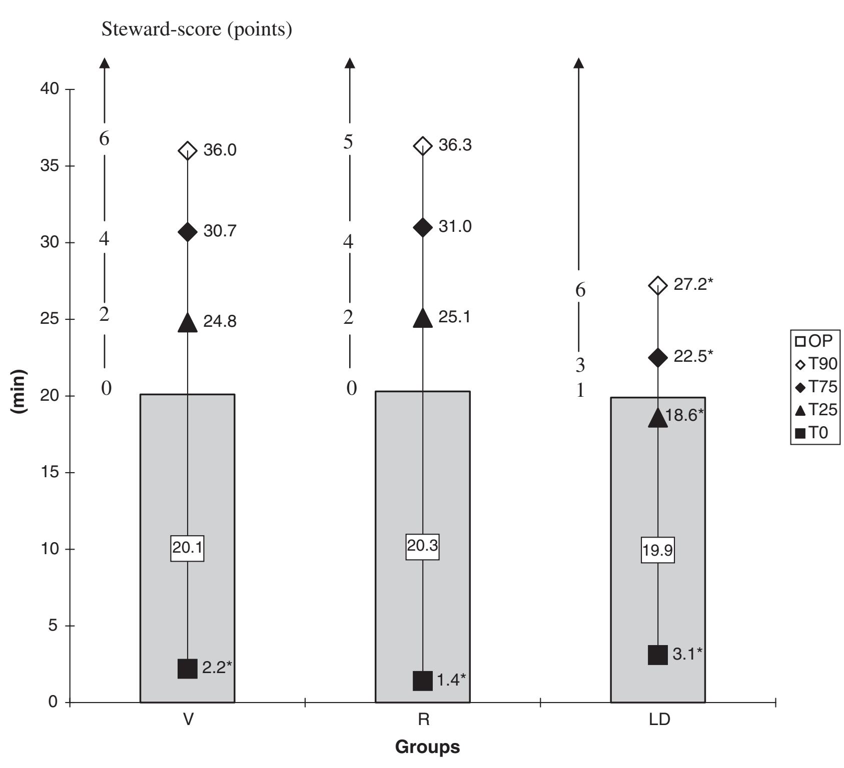

Figure 2
Time difference from the end of tonsillectomy to recovery of neuromuscular block to T90.

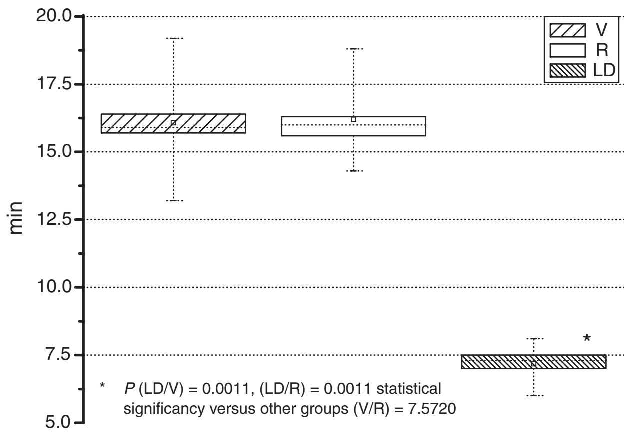

Figure 3
Duration of neuromuscular block in comparison with mean time of tonsillectomy and Steward-score for the assessment of clinical postanesthetic recovery in three study groups (*V*, Vecuronium, 0.1 mg·kg^{-1}; *R*, Rocuronium, 0.6 mg·kg^{-1}; LD, Reduced-dose rocuronium, 0.45 mg·kg^{-1}).

Prolonged onset time (T_0) (3.1 ± 0.34 min) in comparison with standard rocuronium dose (1.4 ± 0.17 min) was comparable with Bevan (13) results and confirmed Geldner G (14) and Bettelli G (5) comments that in spite of other quality, reduced-dose rocuronium with prolonged onset time could not be appropriate option of ideal NMB drug in day case surgery. In elective, day case tonsillectomy in children (6–12 year old, ASA I or II status), prolonged onset time does not influence the patient outcome in absence of obstructive sleep apnea and difficult airway management, and it can be acceptable under particular circumstances according to our experience.

Collins and Klemola has shown that induction dose of propofol (2.5–3.5 mg·kg^{-1}) with alfentanil (20 μg·kg^{-1}) or remifentanil (4 μg·kg^{-1}) gives also acceptable (excellent and good) intubating condition in children when NMB drugs are not used (2,15). Low-dose rocuronium (0.4 mg·kg^{-1}) in addition with propofol and alfentanil/remifentanil anesthesia induction my improve the most excellent intubating conditions without significant hemodynamic changes and prolonged postanesthesia recovery (6,10). Following this, waiting for maximal depression of twitch for intubation is not required in every day practice.

On the other side, measurement the onset time at the maximal depression of the first twitch allowed high percentage of acceptable, especially excellent intubation conditions that are important in avoidance of postoperative hoarseness, sore throat, and vocal cord injures described by Mencke T (16) and Higgins (17).

Duration of NMB (T25) with single reduced-dose rocuronium under propofol–alfentanil anesthesia was 18.6 ± 0.47 min (Geldner G 24.5 ± 4.1 and Khuenl-Brady 15.5 ± 6.5 min) (18,19), and the mean duration of the surgery work was 19.9 ± 1.43 min. Synchronisation of optimal muscular relaxation and regular surgical procedure in our study was noted in 98% of children. Only two children (2%) needed maintenance dose of rocuronium in reduced-dose group during mean tonsillectomy time.

The need for reversal drugs was evident after reduced-dose rocuronium despite our expectation, because 25% of muscle power recovery was present at the end of the tonsillectomy. We supposed that the waiting time to the T_{90} spontaneous twitch recovery would be too long for daily practice, and consequently increased risk of residual paralysis may compromise fast and routine surgical work. Complete neuromuscular function recovery noted by Murphy (20) was rarely present at the time of tracheal extubation after neostigmine reversal of standard dose rocuronium. Omitting the reversal drugs in the early postoperative period, prolongs the stay in recovery room, increases the risk of insufficient diaphragm movements, airway muscle weakness and the respiratory failure in spite of using short- and intermediate-acting NMB drugs (21). Antagonism of residual NM block on the other hand may provoke postoperative nausea and vomiting and consequently delays recovery and increases the hospital stay (22). Reid (23) used reversal drugs for establishing complete neuromuscular function after standard doses of intermediate-acting NMB drugs, in the presence of mouth wound after tonsillectomy especially in children .

We performed tonsillectomy in children on day-case basis only if the procedure was short, without complications and extensive blood loss during and after surgery, if successful recovery of muscle function was established and postoperative nausea and vomiting were prevented and if postoperative pain control provided by topic of local anesthetic on the wounds in combination with one rectal nonopioid drug was sufficient (24).

Adenotonsillectomy is one of the most common emetogenic surgical procedures evaluated in children and one of the commonest causes of significant morbidity (25,26). The management approach is multifactorial and involves proper preoperative preparation, risk stratification, rational selection of antiemetic prophylaxis, choice of anesthesia technique, and a plan for postoperative antiemetic therapy. Regional or local anesthesia should be considered, if possible (27). The incidence of PONV is between 62% and 73% when no prophylactic antiemetic is given. Metoclopramide (0.5 mg kg^{-1}) or ondasteron (0.1 mg kg^{-1}) are the most effective anti-serotinergic agents for the prophylaxis for PONV in children undergoing tonsillectomy. The available nontraditional antiemetics are also propofol, dexamethasone (0.1 mg kg^{-1}), and midazolam (28). Kovac (27) supported multimodal PONV management that includes multiple different antiemetic medications (double or triple combination antiemetic therapy acting at different neuroreceptor sites), less emetogenic anesthesia techniques, adequate intravenous hydration, and adequate pain control.

Akkaya T found that peritonsillar local infiltration of tramadol maintains efficient pain relief after adenotonsillectomy with lower incidence of nausea and vomiting (3.05%) to compare with children without local peritonsillar infiltration of tramadol (12.12%) (28).

We supposed that low incidence rate of PONV in our children (3–6%) was the result of 1) using propofol in continuous infusion during tonsillectomy as protective agent in reduction in nausea and vomiting 2) using alfentanil, high potent opioid with fast clearance 3) good combination of local (2 ml of 0.25% levibupivacaine) and rectal analgesia (NSAID, diclofenac-Na, 1.0 mg·kg^{-1} as one single dose) with VAS score under ≤2 (29).

Rocuronium and vecuronium are intermediate-acting NMBs commonly used in routine clinical practice of pediatric anesthesia. Neuromuscular block induced with short-acting mivacurium has a very short duration and shorter recovery time than rocuronium and vecuronium in children. For these reasons, mivacurium is the most economical muscle relaxants when intense neuromuscular block is mandatory, but only during short time interval (4). Usually, repetitive doses are required to maintain neuromuscular block (30). On the other side, necessity for NMB-reversal drugs after mivacurium application is significantly lower, the residual paralysis is less frequent, which makes it the NMB drug of choice for day-case surgery (31). However, short-acting NMB mivacurium is not available in many countries.

The most day-case adenostonsillectomies are performed on balanced anesthesia technique using isoflourane/sevoflourane–alfentanil or intravenous anesthesia with propofol–remifentanil/alfentanil. Eberhart has shown in 120 patients undergoing ear, nose and throat surgery that the times from the end of surgery to tracheal extubation and the time until leaving the operating room were not different between intravenous anesthesia with propofol–remifentanil when compared with a balanced anesthesia technique using isoflurane–alfentanil. There also was no difference in the quality of recovery between the two groups (32). Comparing three different anesthesia induction and maintenance (propofon, propofol, and sevoflourane), Smith I and co-workers found that induction of anesthesia was the fastest in propofol and propofol/sevoflourane group, although spontaneous ventilation resumed earliest in sevoflourane group. Propofol/sevoflourane group also had the lowest costs based on actual drug use ($14.2) to compare propofol ($18.7) and sevoflourane ($17.3), respectively (32, 33).

NMB drugs may change these findings depending on used neuromuscular drug and its dose. Using intravenous anesthesia with propofol–alfentanil, we tried to escape the influence of volatile anesthetic on NMB duration and recovery.

To compare the time difference from the end of tonsillectomy to the complete recovery of neuromuscular function between study groups, reduced-dose rocuronium brought the highest time benefit of 8.7 ± 0.1 and 8.6 min ± 0.05 min in view of Group R and V. Considering the duration of surgery, reduced-dose rocuronium save the time for one more tonsillectomy when three of them have been performed.

Conclusion

Reduced-dose rocuronium in children allows better control of operating room time, avoids delays in patient recovery, and allows high level of acceptable intubating conditions with providing optimal neuromuscular block during short surgical procedures.

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