

EFFECT OF BODY COMPOSITION ON CISATRACURIUM EFFICIENCY

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Abstract:

Measurement of body composition is proving increasingly important in clinical nutrition and research. In current study we investigated about the effect of body composition on cisatracurium efficiency. In this descriptive cross sectional study, 180 patients with elective non-cardiac surgery under general anesthesia with muscle relaxation and under ventilation with ventilator referred to Shahid Modarres Hospital were selected randomly from simple random sampling. Fat mass and muscle mass (BMI and TBW) in patients, that measured by BODY COMPOSITION ANALYZER set, was recorded and compared with duration of effect time of cisatracurium, extubation time, cisatracurium dose during operation, recovery time, and onset time. Correlation between quantitative variables was determined using Pearson correlation coefficient and Spearman rank tests for statistical analysis of data using SPSS 21 software. In this study p value < 0.05 considered statistically significant. It was concluded that duration of effect time of cisatracurium, extubation time, recovery time, and onset time were decreased with increased muscle mass but the cisatracurium dose during operation was increased, in contrast duration of effect time of cisatracurium, extubation time, recovery time, and onset time were increased with increased fat mass but the cisatracurium dose during operation was decreased.

Introduction

Body composition is the proportion of fat and fat-free mass in your body. A healthy body composition is one that includes a lower percentage of body fat and a higher percentage of fat-free mass, which includes muscle, bones, and organs. (1) Measurement of body composition is proving increasingly important in clinical nutrition and research. Skinfold thickness is a simple means of estimating body composition which is widely used in children, but there is little information on its validity. (2)

Body composition and growth are key components of health in both individuals and populations (3). Measurement of skinfold thickness is currently widely used in children for clinical, research and epidemiological

purposes but there are doubt about validity in efficiency. (4) Body mass index is commonly used as a surrogate measure for body fat content. (5)

Accurate in vivo measurement of FFM may be even more difficult than that of TBW. Although FFM can be estimated by total body Mass, anthropometry, and bioimpedance methods, their value in investigating FFM hydration is obviously limited because of their low accuracy. Streat et al, for example, estimated FFM by skinfold thickness anthropometry. (6)

Previous studies have used only weight, creatinine excretion, or derived anthropometric measures to estimate muscle mass. (7) fat mass increase with age (with a redistribution of body fat), whereas muscle mass decreases. * anesthesia controlled time and turn over time is two of the most important factors that regulate operation room efficiency. Extubation time is of special interests to surgeons and anesthesiologists because it could be affected by different anesthetic agents or techniques. Prolonged extubation is an important factor that would decrease operation room efficiency. Prolonged extubation time would cause slowing of work flow, having OR members staying idly waiting for extubation, and the surgeon have to wait longer for next operation. surgeon always want patients quick to awaken. Accordingly choosing appropriate anesthetic agents or techniques to avoid prolonged extubation is essential for anesthesiologists in order to improve the efficiency of OR. (8)

cisatracurium has been used widely in managing intensive care unit patients, as well as in general anesthesia. (9) Clinical use of these drugs would be facilitated by determining effective combination doses and the pharmacodynamic characteristics that determine the extent of synergistic effects. (10) Because corrected body weight (CBW) was used as the cisatracurium (CisA) dosage calculation, so muscular mass of the obese patients may have been a great importance. (11) Li JY et al. (2016) compare the pharmacokinetics of cisatracurium between normal weight patients and morbidly obese patients and undertook that Cisatracurium doses according to fat-free mass is clinically reasonable for inducing anesthesia in morbidly obese patients, but the

timing of tracheal intubation should be delayed.(12) Salihoglu et al. studied about the neuromuscular effects of cisatracurium in morbidly obese as compared to control group of normal body weight patients and they conclude that neuromuscular agents must be monitored in the morbidly obese patients.(13)

In current study we investigated about the effect of body composition on cisatracurium efficiency.

Material and method

In this descriptive cross sectional study, 180 patients with elective non-cardiac surgery under general anesthesia with muscle relaxation and under ventilation with ventilator referred to Shahid Modarres Hospital in 2018 and 2019 were selected randomly from simple random sampling. The exclusion criteria were the history of neuromuscular disease and use of drugs interfering with neuromuscular transmission, allergy to neuromuscular blocking agents, known intubation problem. Identification of relevant trials was performed by study the papers dated from 1995 to 2018.

Fat mass and muscle mass(BMI and TBW) in patients, that measured by BODY COMPOSITION ANALYZER set, was recorded. Before the anesthetic induction, a catheter 18 was inserted for administration of fluids and drugs. initially the patients were Preoxygenated with 100% oxygen and then premedication, midazolam 0.02 mg / kg and 2 micrograms / kg Fentanyl were used. 2.5 mg / kg propofol For anesthesia induction and 0.2 mg / kg cis-atracurium to access muscle relaxant were injected slowly. Cisatracurium is made by ROSAMED company, The optimum dose of the muscle relaxant was based on the TBW. In order to maintain anesthesia, sevoflurane was used with MAC 3 at 50% oxygen and air. cisatracurium supplement was used if necessary during the operation, and finally the total dose of muscle relaxant was recorded in the questionnaire and the onset time cisatracurium induction, based on TOF reached to zero, was recorded. During operation, the monitoring was involved electrocardiography, non-invasive blood pressure, pulse oximetry, capnography, temperature, TOF and recovery (DBS) and also BIS monitoring throughout the duration of the operation to maintain anesthesia depth . Upon completion of the operation and stopping the anesthetic gas, it took time for the patient to spontaneous breathing, and the Duration time for extubation (on the arrival of TOF to 3) and the Duration Time In Recovery Ward (based on the Aldrete's original scoring system recovery criteria) were recorded in the questionnaire. fat and muscle mass , the onset time, the drug effect and duration of the drug effect were measured and Decisions about the appropriate dosage of muscle relaxant to reduce the occurrence of side effects due to the effect of residual muscle relaxant such as respiratory depression and hypoxia and stay Muscle relaxation is in recovery were

taken. The body composition effect on onset time of cisatracurium, duration time of cisatracurium, extubation time, recovery time, Total dose of the cisatracurium consumed in the whole operation were collected and they were recorded in a pre-made checklist. The results obtained for quantitative variables Worth mean and standard deviation (mean ± SD) and qualitative variables were expressed as the percentage of the class. Correlation between quantitative variables was determined using Pearson correlation coefficient and Spearman rank tests for statistical analysis of data using SPSS 21 software. In this study p value<0.05 considered statistically significant. All measurements are expressed as mean ±SD or 95% confidence interval.

Table 1. demographic information

	mean±SD	min	max
Number of patients	N=180		
age	36.19±11.9	18	60
Male/female	98/82	-	-
TBW	77.33±15.1	50	111
BMI	23.97±3.8	18	36

Table2.

	mean±SD	min	max
Number of patients	N=180		
Extubation time	4.27±1.13	2	8
Fat mass	30.14±7.5	14	45
Muscle mass	33.22±4.01	24	42
Recovery time	44.63±9.14	25	65
Cisatrocurium dose induction	14.85±3.21	10	22
Onset time	4.26±1.14	2	7

Duration time	45.19±9.31	26	70
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Table 3.

	significant	Pearson coefficient
Age.fat mass	0.001	0.236
Age.muscle mass	0.000	-0.273
Gender.fat mass	0.000	0.674
Gender.muscle mass	0.0000	-0.650
TBW.fat mass	0.011	-0.189
TBW.muscle mass	0.000	0.351
BMI.fat mass	0.004	0.422
BMI.muscle mass	0.000	-0.112

Results

among 180 patients in this study, there was 98 males and 82 females and the average age of the patients were 36.19±11.58. The average of TBW and BMI were 77.33±15.14 and 23.97±3.84 respectively (table 1) the effect of fat mass and muscle mass on extubation time (4.27±1.31), recovery time (44.63±9.14), cisatracurium dose induction (14.85±3.21), onset time (4.26±1.14) and duration time (45.19±9.31) were measured and there were significant difference between all of these variables with fat and muscle mass(table 2). Extubation time and duration time and recovery time and onset time were increased in a patients with lower range of muscle mass but the cisatracurium dose were decreased in these patients.

In addition according to statistical analysis, there were significant difference between age, gender, TBW and BMI with both fat mass and muscle mass. According to Pearson correlation coefficient fat mass were increased in older patients, and male's muscle mass was more than females and patients with higher BMI had more fat mass than the patients with low BMI. also the range of fat mass were increased with decreasing of TBW (table 3).

Discussion

The proper use of neuromuscular agents during the operation is necessary for surgical condition. However, because of incomplete recovery of muscle relaxation risks, the appropriate dosage of anesthetics are very important.

On the other hand, administration of high saline doses prolongs muscle relaxation and, as a result, the process of extubation and longer recovery of the patient and increased recovery time, including the loss of suction

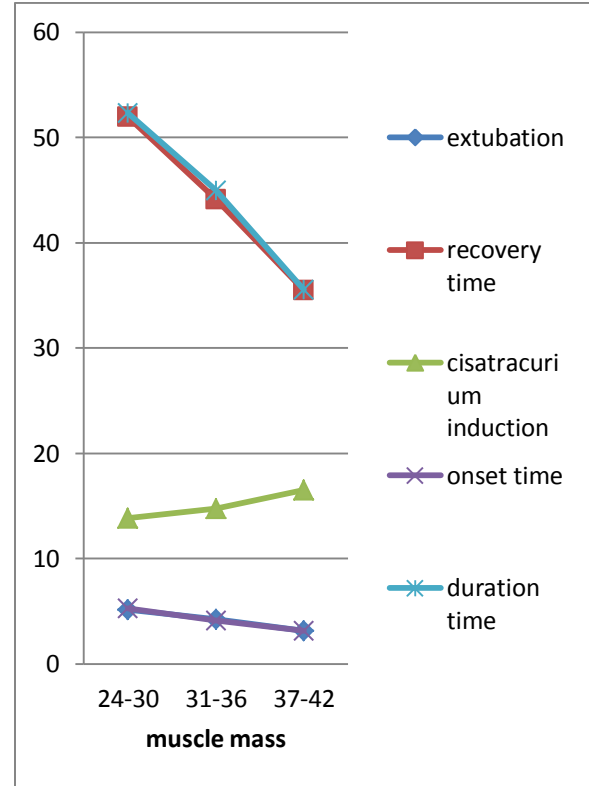


Figure 1. relationship between muscle mass and extubation time, recovery time, cisatracurium induction, onset time, duration time.

Cisatracurium is a bundle of benzylisoquinolones with a long-lasting effect of 30-40 minutes after one dose. The dose of induction is 0.15 mg / kg for cisatracurium. Both cisatracurium and atracurium are removed from the body through Hoffman degradation.

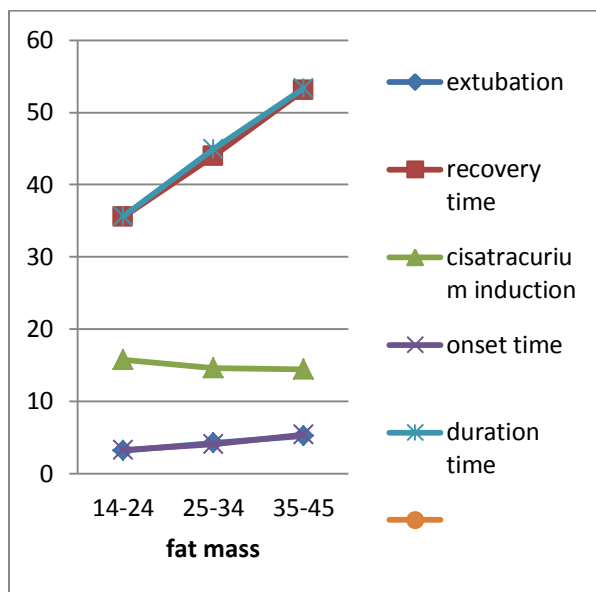


Figure 2. relationship between fat mass and extubation time, recovery time, cisatracurium induction, onset time, duration time.

In this study, we calculated the maximum effect time of muscle relaxant by calculating the percentage of muscle mass, and thus prevent side effects including hypoxia and other complications.

Aging and gender are commonly effect on the body composition. We reported that older patient and males have more muscle mass than the younger patients and females. kim et al. also achieved the same result.(9) Janssen et al. investigated in multiethnic sample of 468 men and women who ranged in age from 18 to 88 yr. and result in Men had significantly ($P < 0.001$) more SM in comparison to women in both absolute terms.(14)

Table4. statistical

	Sig.	Pearson coefficient
Duration time*muscle mass	0.000	-0.687
Duration time * fat mass	0.000	0.774
extubation time*muscle mass	0.000	-0.700
extubation time * fat mass	0.000	0.788
recovery time*muscle mass	0.000	-0.714
recovery time * fat mass	0.000	0.799

Cisatracurium dose *muscle mass	0.000	0.363
Cisatracurium dose * fat mass	0.000	-0.348
onset time*muscle mass	0.000	-0.704
onset time * fat mass	0.000	0.818

As it is shown in table 4, there are significant difference between muscle mass and duration of effect time of cisatracurium, extubation time, recovery time, cisatracurium dose during operation and onset time. The differences between this variables and fat mass were also significant.

Chan et al studied on anesthesia-controlled time and factors that contribute to prolonged extubation in open colorectal surgery and concluded that the anesthesia-controlled time was similar in desflurane anesthesia and propofol-based total intravenous anesthesia for open colorectal surgery in that hospital. Surgical time greater than 210 minutes, as well as age, contributed to prolonged extubation.(15)

Jung et al. had attempted to determine whether or not a priming technique with rocuronium or cisatracurium can affect clinical duration or recovery profiles of cisatracurium. They concluded that Priming with rocuronium for 3 minutes resulted in significantly accelerated onset of cisatracurium. However, it did not affect the clinical duration and recovery profiles of cisatracurium.(16)

Breslin et al. has conducted research on pharmacodynamics interactions between cisatracurium and rocuronium. They administered rocuronium 0.6 mg/kg followed by cisatracurium 0.03 mg/kg when the first twitch in the TOF had recovered to 25%, and found that clinical duration of maintenance doses of cisatracurium was prolonged by 33%.(17)

A large number of studies have been conducted for establishment of pro per methods for reduction of onset time of action with cisatracurium.(18-20)

ZIYA SALİHOĞLU et al. studied On 40 patients with ocular obesity, it was concluded that the effects of cisatracurium in the obese person were different with those in the control group. In fact, changes in the pharmacological dynamics of muscle relaxant bread were due to polarization and hydrofoil and distribution of these drugs in the massif and Lean tissues are affected by obesity. In fact, the total body weight of water in the normal person is 65%, and in contrast to the obese person, it will reach 40%, which has a large impact on the volume of distribution of the drug. However in our

study we concluded that the dose of cisatracurium was decreased in patients with higher fat mass.(12) the same as current study, Kirkegaard-Nielsen et al declared that in people with increased fat mass, dosage regimens should be reduced based on body weight.(21)

Conclusion. In this study, it was concluded that duration of effect time of cisatracurium, extubation time, recovery time, and onset time were decreased with increased muscle mass but the cisatracurium dose during operation was increased, in contrast duration of effect time of cisatracurium, extubation time, recovery time, and onset time were increased with increased fat mass but the cisatracurium dose during operation was decreased.

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