

# Cost Analysis of Neuromuscular Blockers Purchased by Royal Medical Services During the Years 2018-2020

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**Abstract**—Objective: to find out the most cost-effective drugs after analyzing the amounts purchased throughout the study period. **Methods:** Review tenders and/or sub-tenders during the years “2018 to 2020” for daily practice in all RMS hospitals. Comparative parameters include tender and sub-tender median unit price, total cost, onset and duration of action, side effect profile and rationale, and a set of recommendation groups and recommendation groups for each neuromuscular blocker drug purchased in 2014-2016. Conclusions that determine the economic feasibility of available projects that can be secured. **Results:** Suxamethonium had the lowest mean cost in one ampoule cost (\$1.00), followed by Atracurium, Rocuronium (\$1.22, \$ 1.76) and cisatracurium (\$2.6). the cost is calculated based on patient assuming to have a weight of 70 kg using one ampoule, further more analyzing sub tenders Atracurium had the lowest mean cost price in one ampoule (\$1.63), followed by rocuronium (\$2.78) and cisatracurium (\$3.80). The main difference was in rocuronium due to high-cost difference between the main tenders and sub tenders. **Conclusion:** Additional investigations are essential to ensure that the procurements of NMBAs provide the most effective therapy and finest cost, as an investigation may contain an assessment between purchased prices of NMBAs in DRMS and in another institution such as the Ministry of Health throughout the same date.

**Keywords**— Neuromuscular Blockers, tenders, cost.

## I. INTRODUCTION

The pharmacokinetic properties and dosing regimens of the three NMBAs differed (Table 1). Therefore, NMBA has a few advantages and limitations. For example, atracurium Associated with histamine secretion (Ortega, Sarobe, Iribarren, & Giráldez, 2000), caution must therefore be exercised when using this drug in patients that have severe cardiovascular disease or a propensity to approximate histamine release. Vecuronium and rocuronium are normally excreted by the hepatic (Movafegh et al., 2013), so drug clearance is lower in patients with liver failure. Rocuronium bromide had the shortest action of duration. Cisatracurium is an isomer of atracurium (Siler, Mager, & Wyche, 1985), atracurium is less potent 3 times more than Cisatracurium (Kim, Chun, Chon, & Suh, 1998; Loughlin, Weingarten, Nagelhout, & Stevenson, 1996; Sparr, Beaufort, & Fuchs-Buder, 2001), and this NMBA has comparable cardio activity to vecuronium. Vascular stability and organ-independent elimination are similar to atracurium

The selection of different drugs in the same group is based on the principles of safety, effectiveness, and high efficiency. When anesthesiologists decide to use Neuromuscular blocking agents, their goals are rapid and sufficient muscle prolate, hemodynamic stabilization, and predictable and complete muscle recuperation. (MERETOJA, TAIVAINEN, & WIRTAVUORI, 1995; Tsui, Graham, & Torda, 1987) However, if there is no need to choose a drug-based medicine on these criteria, choosing the modification with the lower cost is appropriate (Belmont et al., 1995). As is the case in other areas of medicine, cost containment and efficiency policies require physicians to select the most cost-effective drug when it could be the same clinical outcome achieved

using other alternatives. If The drug is the most expensive, it becomes the preferred drug only if the clinical benefits outweigh the additional cost. However, cost analysis requires more than just measuring vial cost. It is important to consider the dosage required to get the same muscle-relaxing effect, like other associated costs such as administrative costs and management of side effects. costs of mid-term NMBAs vary, as shown in Table (2).

To the best of our knowledge, studies are few have compared the economics of these neuromuscular-blocking drugs (Loughlin et al., 1996; Ortega et al., 2000; Torrance et al., 1996). Furthermore, cisatracurium was only one of the comparator formulations in one of the research (Loughlin et al., 1996). The study was so simple that the authors even pointed out Several costs were not contained and the study should be frequent. Therefore, a detailed cost analysis is required. The main aim of this study was to analyze, evaluate, and compare the quantities and costs of four non-depolarizing neuromuscular blocking agents purchased by the Royal Medical Service Of the four non-depolarizing neuromuscular blockers medications with medium periods of action that are most commonly used for anesthesia (rocuronium, atracurium, and cisatracurium)

## II. METHODS

Analysis of tenders and/or sub-tenders 2018 to 2020; suitable for daily use in Royal Medical Service hospitals. Comparison parameters include the average unit price of bids and bids for each neuromuscular blocking drug purchased in 2018-2020, total cost, side effects, the time of onset, duration action, and rationale, as well as a set of recommended groups and economics of ensuring available items conclusion.

Table 1: Dosing schedules and pharmacokinetic characteristics of neuromuscular blocking agents included in the study.

NMBA's	Induction dose mg/kg	Maintenance dose mg/kg	Onset (min.)	Duration of induction	Duration of maintenance dose	Recover time (min)	Histamine release	Elimination
atracurium	0.4-0.5mg/kg	0.08-0.2	1.5-2.5	20-35	15-35	35	Yes	Hofmann degradation
cisatracurium	0.1-0.15mg/kg	0.03	1.2-2	40-55	20	30	No	Hofmann degradation
rocuronium	0.6-0.9mg/kg	0.15	1	30-40	13	25-30	No	Mainly hepatic
Suxamethonium	1-2mg/kg	0.04-0.07 mg/kg	1	2	5-10	4-6	No	Renally

The neuromuscular agents: table (2)

NMBA's	Intubating Dose	Vial	Vials to intubate 70 kg patient	price in main tenders / vial (JD)	price in main tenders / vial (US\$)	price in sub tenders / vial (JD)	price in sub tenders / vial (US\$)
Atracurium	0.4-0.5mg/kg	50mg	1	0.867	1.22	1.16	1.63
cisatracurium	0.1-0.15mg/kg	20mg	1	1.846	2.60	2.70	3.80
rocuronium	0.6-0.9mg/kg	50mg	1	1.25	1.76	1.98	2.78
Suxamethonium	1.5mg/kg	100mg	1	0.71	1.00	-----	-----

A retrospective cost analysis was performed for the four neuromuscular blocking agents suxamethonium, rocuronium, cisatracurium, and atracurium. The cost of medicines is covered by the Royal Medical Service Pharmacy Department. Some neuromuscular blocking agents are available in both brand names and common brands. cost per vial of each drug used in the study was summarized using the original cost per mg and generic medications cost. Entirely costs were converted to U.S. dollars using the JOD/USD exchange percentage of 0.71 and estimated in U.S. dollars. (Table 1)

Assume no difference with other anesthetics that can be used before/before/after surgery or other interventions (narcotic antagonists such as neostigmine, inhaled anesthetics, etc.).For illustration, if an anesthetist selects an NMBA for the same type of surgery, the only modification between the NMBAs is the price of the medication.

### III. RESULTS

Table 2, it can be observed that Suxamethonium boasted the least expensive cost per ampoule, averaging at \$1.00, followed by Atracurium (\$1.22). Following this were rocuronium and cisatracurium, which cost \$1.76 and \$2.60 per ampoule, respectively. This cost is determined by assuming a patient weighing 70 kg and the use of one ampoule. Fig. 1 reveals that even after analyzing sub-tenders, Atracurium remained the most affordable option, with a mean cost of \$1.63 per ampoule. Rocuronium and cisatracurium followed, costing \$2.78 and \$3.80 per ampoule, respectively, for suxamethonium there were no subtenders to be purchased. Of note is the significant cost discrepancy in rocuronium between main bids and sub-bids, Fig [2]

### IV. DISCUSSION

Several patients are treated with anesthesia and muscle relaxants each year. A negligible proportion of hospital

execution costs is concentrated on anesthetic drugs, generally 0.20% of the hospital funds (Koçkaya, Kockaya, & Liestyo, 2011), but they represent a significant portion of the variable cost of anesthesia care (Suttner, Boldt, Piper, Schmidt, & Kumle, 2000). Policymakers are driving innovative measures to reduce anesthesia costs and maintain healthcare quality. Subsequently neuromuscular blocking agents exemplify nearly 31% of the total anesthetic drug funds in the US. (Koçkaya et al., 2011), these pharmaceuticals are viable targets for anesthesia cost minimization programs (Hans, Welter, Dewandre, Brichant, & Bonhomme, 2004).

A cost investigation was performed to examine the direct costs of diverse neuromuscular blocking medications procured from primary and secondary tenders during the period 2014-2016(Msc. Pharm. Nancy Shishani \* et al.). in the main tender document. For atracurium, the difference between the average unit price of the main bid and the sub-bid is small, and for cisatracurium, the difference between the average unit price of the main bid and the sub-bid is relatively large. On the other hand, the largest average cost difference was for Rocuronium fig. (2).

All costs and privileges or alternatives are calculated in financial stipulations through a cost-benefit analysis. Results can be given as a percentage (benefits to costs) or as net costs or net benefits. The conclusive tricky through this type of investigation is that it is difficult to translate certain non-financial units. Therefore, cost-benefit analysis is used more frequently. A study in Turkey showed that management in Turkish hospital groups consisted of atracurium and vecuronium with a procedure time of fewer than 30 minutes, vecuronium with a procedure time of 30 to 60 minutes, and vecuronium with a procedure time of 60 minutes or more. Neuromuscular Blocking Agents can be chosen to reduce costs through (COOPER & HUTTON, 1995).

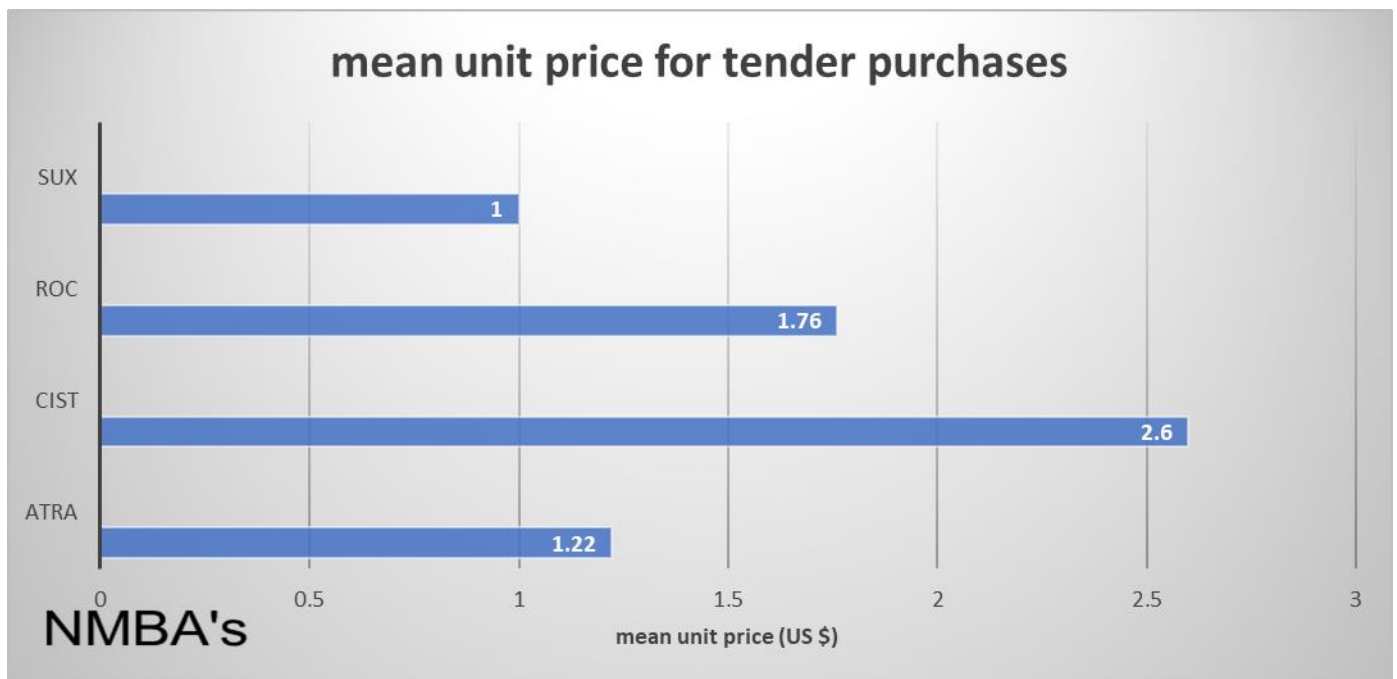


Fig (1)

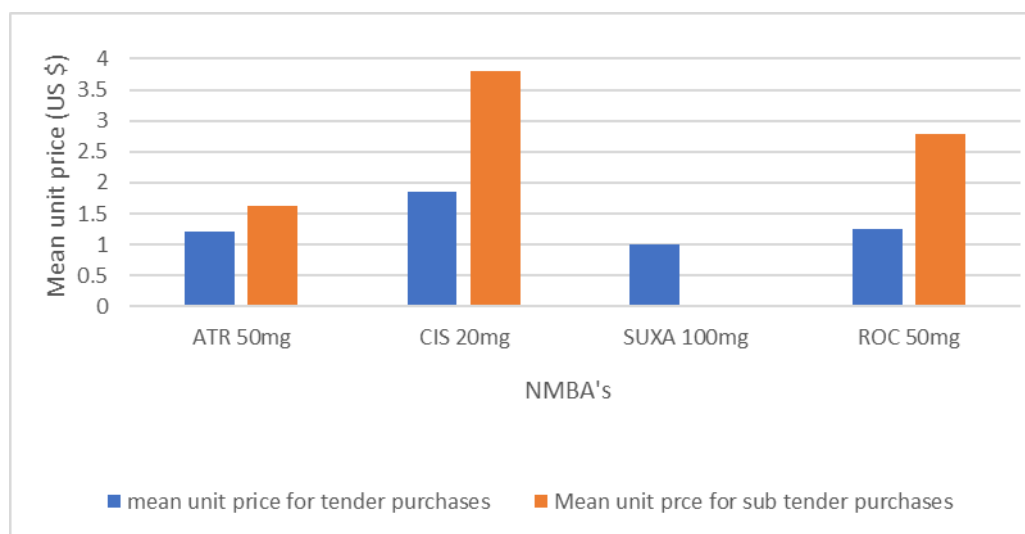


Fig (2)

## V. CONCLUSION

Additional investigations are essential to ensure that the procurements of NMBAs provide the most effective therapy and finest cost, as an investigation may contain an assessment between purchased prices of NMBAs in DRMS and in another institution such as the Ministry of Health throughout the same date. Implementing NMBAs will improve protection and make it possible to produce fewer or unexpected actions. Limiting the amount of NMBAs purchased, and obtaining appropriate quantities will ensure the constant availability of these medications and will avoid sub-tender purchases which have a tendency to be extra expensive. Precise assessment of quantity and type of NMBAs mandatory will avoid overstock or lack of stock and will save effort and money.

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