

# Efficacy and safety of ropivacaine HCl in peribulbar anaesthesia for cataract surgery in patients with myotonic dystrophy type 1

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Myotonic dystrophy (DM1) is the most common muscle disease in adults, affecting approximately 1:8000 individuals, characterized by myotonia and muscular wasting and a multisystemic involvement that includes heart, brain, respiratory and endocrine system, and eye. Conduction system is selectively involved, often causing cardiac sudden death. Early onset posterior subcapsular cataract is a characteristic feature of myotonic dystrophy, requiring surgical treatment. However, DM1 is associated with many anesthetic hazards; sensitivity to anesthetic drugs, especially muscle relaxants and opioids, may complicate postoperative care. Local anesthesia also requires attention. We investigated the heart response to local anesthesia Ropivacaine HCl administration in 16 DM1 patients (12M:4F) consecutively undergoing cataract surgery, by analyzing heart rate, ventricular and supraventricular ectopic beats, runs of tachycardia and pauses  $\geq 2.5$  sec., through a 24h-Holter monitoring, registered before and within 24 hours after surgery. The average age of patients was 47.4 years (range 30.2-55.9). At baseline, one patient had a pacemaker and 3 a defibrillator. Two patients presented a first-degree atrio-ventricular-block; three showed ectopic ventricular beats, on anti-arrhythmic drug treatment. No significant differences in heart rate values ( $73 \pm 15$ b/m versus  $76 \pm 13$ b/m) were observed after cataract surgery, nor in the onset of ectopic beats. Only patients who presented ventricular ectopic beats at baseline, showed an increase in their number after surgery, likely related to an arbitrary interruption of the specific treatment. These data confirm the safety and efficacy of ropivacaine HCl used as a local anesthetic in patients with myotonic dystrophy.

**Key words:** peribulbar anaesthesia, ropivacaine HCl, myotonic dystrophy, cataract surgery

Received: April 10, 2020  
Accepted: May 26, 2020

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## Conflict of interest

The Authors declare no conflict of interest

**How to cite this article:** Palladino A, De Bernardo M, Scutifero M, et al. Efficacy and safety of ropivacaine HCl in peribulbar anaesthesia for cataract surgery in patients with myotonic dystrophy type 1. Acta Myol 2020;39:90-3. <https://doi.org/10.36185-2532-1900-011>

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## Introduction

Myotonic dystrophy type 1 (DM1) or Steinert's <sup>1</sup> disease is the most frequent muscle disease in adults caused by the expansion of the trinucleotide CTG into the 3' UTR of the *DMPK* gene (19q13). Age of onset and severity of the disease are closely related to the number of repeats: 5-37 repeats are present in normal individuals, 50-150 in individuals mildly affected, from 100 to more than 1,000 repeats in patients with the classic DM1 phenotype. Repeats greater than 2000 are found in subjects with congenital onset pathology <sup>2</sup>.

DM1 is a multisystemic disorder involving muscle, heart, brain, respiratory and endocrine systems, and eye<sup>3</sup> that requires a multidisciplinary approach and management<sup>4</sup>. Cardiac involvement, due to selective damage of the conduction system consequent to fibro-adipose accumulation in the sinus node and His bundle, is characterized by atrio-ventricular (a-v) blocks, bundle branch blocks, tachy/brady arrhythmias, which predispose to sudden death<sup>5,6</sup>.

A variety of ocular signs is described in DM1 patients, like cataract, retinal degeneration, low intraocular pressure (IOP), eyelid ptosis, epiphora, corneal lesions, extraocular myotonia, extraocular muscle weakness, abnormal central control of eye movement<sup>7-9</sup>. Early onset (< 50 years of age) posterior subcapsular cataract is a characteristic feature of myotonic dystrophy type 1 and 2 and, at least for DM1, is known to be a key feature for timely diagnosis. So, sometimes, the ophthalmologist is the first doctor a patient would visit, as cataract often precedes all other symptoms<sup>10-13</sup>. In these cases, and especially in the absence of other secondary causes of cataract, awareness by the treating physician that early onset cataract can be a presenting manifestation of a multisystemic disease, is essential for appropriate referral of patients, avoidance of unnecessary examinations and timely diagnosis. Nevertheless, to our experience, many patients with DM1, despite being diagnosed and operated at a young age for posterior subcapsular cataract, remain undiagnosed for years and are referred for evaluation at a neuromuscular unit only after appearance of muscle weakness or other symptoms of the disease<sup>14</sup>.

Myotonic dystrophy is associated with numerous anesthesiological risks<sup>15,16</sup>. Myotonia can be triggered by hypothermia, chills, electrical and/or mechanical stimulations. Moreover, sensitivity to anesthetic drugs, especially muscle relaxants and opioids, can complicate the post-operative course. The presumed hypersensitivity to neostigmine and a double response to the caffeine test impose a cautious evaluation in the choice of anesthetics, while the predisposition to arrhythmic events poses problems in the use of local anesthetics, with the result of a veiled resistance by anesthesiologists to subject these patients to anesthesiological procedures<sup>16</sup>.

Ropivacaine HCl, a long-acting member of the amino amide class of local anesthetics, indicated for surgery and acute pain management, has been recently used for ocular surgery. Compared to lidocaine and bupivacaine, it presents the advantage to have a less deep and shorter motor block, and minor cardiac toxicity<sup>17</sup>.

Aim of this work was to investigate through 24h-Holter monitoring, performed before and within 24 hours post-surgery, the heart response to the local retrobulbar administration of ropivacaine HCl (naropin), in a group of patients with DM1 undergoing cataract surgery.

## Patients and methods

Sixteen patients (12M:4F), mean age 47.4 year (range 30.2-55.9) affected by myotonic dystrophy type 1, confirmed by molecular analysis and followed at the Cardiomyology and Medical Genetics of the University of Campania "Luigi Vanvitelli", underwent cataract surgery, through phaco-emulsification. Four patients had a cardiac device (1PM and 3ICD) due to atrio-ventricular (A-V) blocks or tachyarrhythmias, at the time of surgery. Three patients were on anti-arrhythmic drugs (amiodarone or bisoprolol) for tachyarrhythmias.

Before cataract surgery, all patients had a full cardiological assessment including clinical investigation, standard and 24h-Holter ecg monitoring, echocardiography and respiratory assessment. The following cardiological parameters were evaluated at baseline and after the surgery: heart rate (HR), supraventricular and ventricular ectopic beats (SVB, VEB), runs of tachycardia, pauses  $\geq 2.5$  sec.

Anesthesia was induced through peribulbar block, effective both on pain sensitivity and ocular motility, obtained by multiple infusions of 0.8 ml of 10% ropivacaine HCl, a member of the amino amide class of local anesthetics. This drug was chosen for its prolonged sensitive and motor block, and scarce cardiac and systemic toxicity. The mydriatic effect, necessary for a good visualization of the operative field, was obtained by the insertion of tropicamide 0.28 mg/phenylephryne 5.4 mg (mydriasept) in the inferior conjunctival sac, two hours before the surgery. The crushing of the lens was obtained through ultra-high frequency ultrasounds, followed by the insertion of an elastic intraocular lens.

### Statistical analysis

Student t test for paired data was applied to compare mean values; Statistical significance was set at p-value < 0.05 (nominal significance).

## Results

Table I shows cardiological data obtained before and after cataract surgery in DM1 patients. None of patients had episodes of tachycardia or pauses > 2.5 sec, at 24h-Holter baseline. Two male patients presented ventricular ectopic beats > 500/die and were on amiodarone and bisoprolol drugs, respectively.

The analysis of the ecg tracings registered during and for 24 hours after the phacoemulsification procedure, showed that 13/14 patients with no ventricular ectopic beats at basal 24h-Holter, did not develop arrhythmias in 24 hours after surgery. One of the patients having an ICD, developed ventricular ectopic beats within 24 hours

**Table I. 24h-Holter cardiological data before and after surgery in DM1 patients studied group.**

	Mean HR (b/m)		VEB		SVB		Couples		Bigeminism		Trigeminism		P value
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After	
Pt. 01	60	58	1	67	154	0	0	0	0	0	0	0	
Pt. 02	100	103	0	0	0	0	0	0	0	0	0	0	
Pt. 03	75	68	0	0	0	0	0	0	0	0	0	0	
Pt. 04	88	93	0	0	10	0	0	0	0	0	0	0	
Pt. 05	80	90	0	61	0	0	0	0	0	0	0	0	
Pt. 06	75	76	0	0	372	86	0	0	0	0	0	0	
Pt. 07	65	72	0	0	0	0	0	0	0	0	0	0	
Pt. 08	90	82	0	0	0	0	0	0	0	0	0	0	
Pt. 09	60	75	0	0	0	0	0	0	0	0	0	0	
Pt. 10	93	75	1355	3613	163	16	3	178	1	65	0	13	
Pt. 11	60	64	0	741	0	0	0	0	0	0	0	2	
Pt. 12	53	57	302	1372	26	78	0	0	1	2	0	6	
Pt. 13	70	86	0	0	0	0	0	0	0	0	0	0	
Pt. 14	55	66	0	0	8	16	0	0	0	0	0	0	
Pt. 15	82	79	0	0	0	5	0	0	0	0	0	0	
Pt. 16	79	70	0	0	2	5	0	0	0	0	0	0	
<b>Mean</b>	<b>74,1</b>	<b>75,9</b>											<b>0.68</b>
<b>SD</b>	<b>14.4</b>	<b>12.7</b>											

HR : Heart Rate; VEB: ventricular ectopic beats; SVB: supraventricular beats

after surgery, but not in close relation to it. The patients who had ventricular ectopic beats > 500/die at baseline, showed an increase in the number of extrasystoles within 24 hours after surgery. However, they have arbitrarily stopped medication the day before surgery.

#### Statistical analysis

The analysis of heart rate values – before and after surgery – did not show differences statistically significant.

## Discussion

Myotonic dystrophy (DM1) is the most common muscle disease in adults characterized by myotonia and muscular wasting and a multisystemic involvement that affects heart, brain, respiratory and endocrine system, and eye<sup>1-4</sup>. There is a high risk of cardiac sudden death due to conduction system anomalies<sup>5,6</sup>. A variety of ocular signs is described in DM1 patients, the most frequent and characteristic of them is posterior subcapsular cataract requiring surgical treatment. DM1 poses serious anesthesiological problems due to the associated neuromuscular and multi-organ implications, in both general and local anesthesia<sup>7-13</sup>. Adrenaline and lidocaine, alone or in combination with other anesthetics, generally used to induce vasoconstriction and to prolong the anesthetic effect

and control pain, are contraindicated for the known side effects on the cardio-vascular system (tachy-brady ventricular and supraventricular arrhythmias, hypertensive or hypotensive crises).

The use of local anesthetics of the amide and ester group, is preferable – whenever possible – in these patients. Several eye surgery studies<sup>18-22</sup> requiring peribulbar blockade, conducted on patients not affected by DM1, have shown that ropivacaine is preferable to other drug combinations, because it produces long lasting rapid and deep blockage – sensory and motor – of the eye, normal recovery of the ocular motor function, and minor topical and systemic side effects.

Gioia et al.<sup>20</sup>, evaluating clinical properties of 0.75% ropivacaine and a 1:1 mixture of 2% lidocaine and 0.5% bupivacaine for peribulbar anesthesia, demonstrated that ropivacaine has an onset similar to that of the lidocaine-bupivacaine mixture and provides a better quality of postoperative analgesia.

Zhou et al.<sup>21</sup>, in a prospective, randomised, double-masked comparison of local anaesthetic agents for vitrectomy, compared the intraoperative and postoperative clinical properties of 1% ropivacaine, 0.75% bupivacaine, 2% lidocaine and a mixture of 0.75% bupivacaine and 2% lidocaine (bupi+lido) administered for peribulbar anesthesia in 140 patients. They reported that 1% ropivacaine alone provides an adequate intraoperative anaesthesia similar to that provided by the bupivacaine,

lidocaine and lido+bupi solutions, as well as a better quality of postoperative analgesia. Furthermore, they showed that the incidence of postoperative subconjunctival haemorrhage was decreased in the ropivacaine group compared with the other three groups.

Our data – though limited to a small group of patients with myotonic dystrophy type 1 – confirm these studies and provide anesthesiologists with further evidence of the efficacy and safety of ropivacaine for ocular surgery also in patients with neuromuscular disorders.

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