

Acetylcholine chloride 1% usage for intraoperative cataract surgery miosis

Cloridrato de Acetilcolina 1% na obtenção da miose intraoperatória na cirurgia de catarata

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ABSTRACT

Objective: To test the efficacy of Acetylcholine chloride use in obtaining intraoperative miosis on phacoemulsification cataract surgery. **Methods:** Patients with cataract diagnosis and elected for surgical phacoemulsification procedure were selected. All patients underwent conventional phacoemulsification procedure performed by a single surgeon and all patients had 0.2 ml of Acetylcholine chloride 1% irrigated in the anterior chamber at the end of the surgery. The pupillary diameter was measured immediately before the beginning of surgery, immediately before and two minutes after the use of acetylcholine chloride 1%. **Results:** A total of 30 eyes from 30 patients were included in the study. 18 were female, and mean age was of 69.5 years with a 7.2y standard deviation on the population study. The mean pupillary diameter immediately before the beginning of surgery was 7.5 mm with a standard deviation of 0.56 mm; the mean pupillary diameter immediately before the acetylcholine chloride 1% use (after the intraocular lens im-plantation) was 7.1 mm with a standard deviation of 0.57 mm. The mean pupillary diameter two minutes after the use of acetylcholine chloride 1% in the anterior chamber was 3.4 mm with standard deviation of 0.66 mm. The mean maximum action time of ACH chloride 1% was 64 seconds, with a standard deviation of 8 seconds. The mean intraocular pressure on the first postoperative day was 19.1 mmHg with a standard deviation of 2.45 mmHg. **Conclusion:** We conclude that acetylcholine chloride 1% is an important drug to obtaining intraoperative miosis in cataract surgery.

Keywords: Acetylcholine/administration & dosage; Cholinergic agonists/administration & dosage; Phacoemulsification; Cataract extraction; Miosis

RESUMO

Objetivo: Demonstrar a eficácia do cloridrato de acetilcolina 1% na obtenção da miose intraoperatória na cirurgia de catarata pela técnica de facoemulsificação. **Métodos:** Pacientes com diagnóstico de catarata e indicação de cirurgia foram selecionados para participar do presente estudo. Todos os pacientes foram operados pela técnica de facoemulsificação convencional pelo mesmo cirurgião, todos foram submetidos à aplicação de 0,2 ml do cloridrato de acetilcolina 1% na câmara anterior ao final do procedimento cirúrgico. A medida do diâmetro pupilar foi realizada imediatamente antes do início da cirurgia, imediatamente antes do uso do cloridrato de acetilcolina 1% e após 2 minutos. **Resultados:** Foram estudados 30 olhos de 30 pacientes, destes, 18 eram do sexo feminino, a média de idade do estudo foi de 69,5 anos com desvio padrão de 7,2 anos. A média do diâmetro pupilar imediatamente antes do início da cirurgia foi 7,55 mm com desvio padrão de 0,56mm, a média do diâmetro pupilar imediatamente antes do uso do cloridrato de acetilcolina 1% (após implante da lente intraocular no saco capsular) foi 7,1mm com desvio padrão de 0,57mm. A média do diâmetro pupilar após 2 minutos da aplicação da acetilcolina na câmara anterior foi de 3,4 mm com desvio padrão de 0,66mm. O tempo médio de ação máxima do medicamento foi de 64 segundos, com desvio padrão de 8 segundos. A média da pressão intraocular no primeiro dia do pós-operatório foi de 19,1 mmHg com desvio padrão de 2,45mmHg. **Conclusão:** O estudo acima mostrou que a acetilcolina apresenta boa eficácia na obtenção de miose intraoperatória na cirurgia de facoemulsificação, permitindo uma maior facilidade na confecções das suturas corneanas ou corneo-escleral, reduzindo a incidência de sinéquias anteriores periféricas. Concluímos que o cloridrato de acetilcolina 1% é um importante medicamento na obtenção da miose intraoperatória na cirurgia de catarata.

Descritores: Acetilcolina/administração & dosagem; Agonistas colinérgicos/administração & dosagem; Facoemulsificação; Extração de catarata; Miose

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Os autores declaram não haver conflito de interesses.

Recebido para publicação em 30/05/2017 - Aceito para publicação em 07/09/2017.

INTRODUCTION

Cholinergic agonists are drugs producing similar responses to Acetylcholine. These are also known as miotic or parasymphathomimetic. They are classified according to their mechanism of action as direct and indirect.⁽¹⁾

The direct cholinergic agonists bind and activate cholinergic receptors in the junctions of the iris sphincter muscle promoting pupillary constriction. The Indirect Cho-linergic Agonists carry their effects primarily by inhibiting Acetylcholinesterase which in turn increases the available acetylcholine to the cholinergic receptors.⁽¹⁾

Acetylcholine (ACH) chloride 1% is a direct agonist, being a neurohormone that mediates nervous signal transmission in all cholinergic sites involving autonomic and somatic nerves. Upon its release it is rapidly inactivated by the acetylcholinesterase enzyme.⁽²⁾

Amsler and Verrey were the first to register the use of acetylcholine chloride to obtain intraoperative miosis after lens extraction.⁽³⁾

Harley and Mishler in 1964, after many testing, reached a most effective Acetylcholine chloride concentration of 1:100, which is the most largely used nowadays.⁽³⁾

Currently, the miotic agents are frequently irrigated in the anterior chamber during intraocular surgeries such as phacoemulsification, penetrating keratoplasty, trabec-tulectomy, iridectomy among others.⁽⁴⁾

Some of the benefits gained from the usage of miotic agents are the greater ease to perform scleral or corneal sutures, insertion of anterior chamber lens and the decrease of post-operative peripheral anterior synechiae.⁽⁴⁾

Obtaining satisfactory miosis quickly and safely is often necessary and the direct irrigation of Acetylcholine Chloride 1% in the anterior chamber can produce a short-duration miosis and a regular pupil after the insertion of the intraocular lens.

The objective of this study is to test the efficacy of Acetylcholine chloride use in obtaining intraoperative miosis on phacoemulsification cataract surgery.

METHODS

Thirty patients with cataract diagnosis and elected for phacoemulsification procedure were selected to participate of the present study. After research project approval by the Ethics and Research Committee of Escola Paulista de Medicina (EPM), all patients read and signed the Informed Consent Form (ICF) before surgery.

The present study had as inclusion criteria:⁽¹⁾ patients older than 50 years, both sexes; ⁽²⁾ cataract diagnosis and elected for phacoemulsification with intraocular lens implantation surgery. As exclusion criteria: ⁽¹⁾ past history of eye disease; ⁽²⁾ glaucoma; ⁽³⁾ previous eye infection ⁽⁴⁾ past history of ocular surgery in the study eye; ⁽⁵⁾ diabetes ⁽⁶⁾ ocular diseases affecting pupillary dilation ⁽⁷⁾ presence of posterior synechiae.

All patients underwent general preoperative evaluation including: Best corrected visual acuity in both eyes, goldman tonometry, anterior chamber biomicroscopy and binocular indirect ophthalmoscopy examination under pharmacologic mydriasis.

Pupillary dilation on the day of operation was obtained by a one drop of phe-nylephrine 10% and after a five-minute interval one drop of tropicamide 1%, repeated three times in the eye to be operated.

Each operation was performed by a single surgeon (FD). Under topical anesthesia (using proximetacaine chloride 0.5% eyedrops immediately prior to surgery), a 2.75-mm clear corneal incision was made superotemporally with a steel blade. The anterior chamber was then filled with a dispersive (Methylcellulose 2%, Ophthalmos, Brazil) viscoelastic material. After continuous curvilinear capsulorhexis, hydrodissection and hydrodelineation were performed. Then, a sideport entrance was created with a 15° knife. The lens nucleus was removed using the “phaco-chop” technique (Laureate, Phacoemulsification System, Alcon, USA). Subsequently, the cortex was aspirated with coaxial irrigation/aspiration. The capsular bag was filled with a same dispersive visco-elastic before a foldable monofocal posterior chamber IOL (Type 7B, Alcon, USA) was implanted in the capsular bag through an injector system. At the end of surgery, after intraocular lens implantation and viscoelastic aspiration from the anterior chamber, 0.2 ml of Acetylcholine chloride 1% (Ophthalmos - Industry and Commerce of Pharmaceutical Products®) was irrigated. The entrances were closed with stromal hydration.

The pupillary diameter was measured immediately before the beginning of surgery, immediately before and two minutes after the use of acetylcholine chloride 1%.

The measurement of pupillary diameter was performed with a millimeter spatula that could be inserted in the anterior chamber through the 2.75 mm incision with 0.5 mm markings.

Patients instilled topical antibiotic (ciprofloxacin 0.3% ophthalmic solution) and topical corticoid (dexamethasone 0.1% ophthalmic solution) postoperatively four times a day for seven days.

On days 1, 7 and 30, patients underwent new measure of best corrected visual acuity, goldmann tonometry, anterior chamber biomicroscopy and binocular indirect ophthalmoscopy examination under pharmacologic mydriasis.

The effect of acetylcholine chloride 1% on postoperative intraocular pressure correlated with preoperative values using the analysis of variance, a value of $p < 0.05$ was accepted as significant. All statistical analyses were performed using commercially available statistical software (SPSS version 21, SPSS, Inc., Chicago, IL).

RESULTS

A total of 30 eyes from 30 patients were included in the study. 18 were female, and mean age was of 69.5 years with a 7.2y standard deviation on the population study. None of the 30 surgeries presented intraoperative complications.

The mean pupillary diameter immediately before the beginning of surgery was 7.5 mm with a standard deviation of 0.56 mm; the mean pupillary diameter immediately before the acetylcholine chloride 1% use (after the intraocular lens implantation) was 7.1 mm with a standard deviation of 0.57 mm.

The mean pupillary diameter two minutes after the use of acetylcholine chloride 1% in the anterior chamber was 3.4 mm with standard deviation of 0.66 mm. (Table 1)

Table 1
Mean of pupillary diameter with a standard deviation after application of ace-tylcholine hydrochloride 1%

Application of acetylcholine hydrochloride 1%	mm
Immediately before surgery	7.55 ± 0.56
Immediately before the application	7.1 ± 0.57
Two minutes after the application	3.4 ± 0.66

The mean maximum miosis of ACH chloride 1% was 54 seconds, with a standard deviation of 8 seconds. (Figure 1)

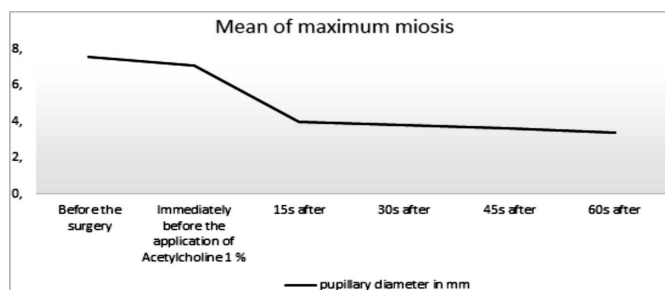


Figure 1: Mean of maximum miosis after application of acetylcholine hydrochloride 1%.

The mean preoperative intraocular pressure was 16.7 mmHg with a standard deviation of 0.9 mmHg. The mean intraocular pressure on the first postoperative day was 19.1 mmHg with a standard deviation of 2.45 mmHg.

On the seventh postoperative day, the mean intraocular pressure was 16.2 mmHg with a standard deviation of 2.1 mmHg. The mean intraocular pressure on the thirtieth day of follow-up was 16.3 mmHg with a standard deviation of 1.3 mmHg.

DISCUSSION

Miotic agents are largely used after ocular surgeries, phacoemulsification among them, in order to obtain a regular round pupil, prevention of anterior synechiae, aid to perform corneal and corneal-scleral sutures, and reduce risk of pupillary capture.

ACH chloride 1% in the present study has shown to be an effective intraoperative miosis-inducing agent.

The study by Beasley⁽³⁾ shows a less prolonged miosis using ACH Chloride when compared with other miotic agents because the ACH Chloride is more rapidly inactivated by acetylcholinesterase.

Regarding intraocular pressure, there was no statistically significant difference ($p > 0.05$) when compared to preoperative intraocular pressure and first postoperative day intraocular pressure.

Hollands et al.⁽⁴⁾ found a statistically significant difference when comparing ACH Chloride with placebo in the first 3 – 6 hours postoperatively after cataract surgery and later from 9 – 12 hours, although the control group had lower intraocular pressure measurements, there were no statistical validity in these findings.

CONCLUSION

We conclude that acetylcholine chloride 1% is an important drug to obtaining intraoperative miosis in cataract surgery.

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