ULTRASOUND BIOMICROSCOPY IN DEEP SCLERECTOMY WITH A NEW ACRYLIC IMPLANT

BIOMICROSCOPÍA ULTRASÓNICA EN ESCLERECTOMÍA PROFUNDA NO PERFORANTE CON UN NUEVO IMPLANTE ACRÍLICO

CONTRERAS I1,3, NOVAL S1,3, MUÑOZ-NEGRETE FJ2,3, REBOLLEDA G2,3, GARCÍA-FEIXOÓ J2,4, DE LA CÁMARA J2,5,*

ABSTRACT

Objective: To describe the ultrasound biomicroscopic (UBM) characteristics seen in patients who have undergone deep phaco-sclerectomy with a new acrylic implant (Esnoper®).

Subjects, material and methods: UBM exploration was performed 12 months after deep phaco-sclerectomy in three patients with chronic open angle glaucoma.

Results: One year after surgery, all three patients had intraocular pressure levels under 15 mmHg and were on no treatment. All of them had an intrasceral space in UBM, in which the hyperechogenic implant was visible.

Conclusions: The new non-absorbable implant has proven to be effective in these cases. Information provided by UBM is useful and assists in understanding the mechanism of action of deep sclerectomy (Arch Soc Esp Oftalmol 2006; 81: 445-450).

Key words: ultrasound biomicroscopy, deep sclerectomy, acrylic implant, open angle glaucoma, deep phaco-sclerectomy.

RESUMEN

Objetivo: Describir los hallazgos del examen con biomicroscopia ultrasónica (BMU) de pacientes operados de facoesclerectomía profunda no perforante con un nuevo implante acrílico (Esnoper®).

Sujetos, materiales y métodos: Exploración con BMU 12 meses después de facoesclerectomía profunda no perforante en tres pacientes con glaucoma crónico de ángulo abierto.

Resultados: Tras un año de seguimiento, los tres pacientes presentan presiones intraoculares menores de 15 mmHg sin tratamiento. En todos ellos, existe un lago intraescleral demostrable por BMU, donde es visible el implante hiperecogénico.

Conclusiones: El nuevo implante no reabsorbible ha sido eficaz a medio plazo en esta serie de casos. La información aportada por BMU ayuda a comprender el mecanismo de acción de la cirugía no perforante.

Palabras clave: biomicroscopía ultrasónica, esclerectomía profunda no perforante, implante acrílico, glaucoma ángulo abierto, facoesclerectomía profunda no perforante.
INTRODUCTION

Non-penetrating deep sclerectomy (NPDS) is a filtrating surgical technique designed to decrease intraocular pressure (IOP) in patients suffering from open angle glaucoma not controlled with topical medication and presenting a lesser number of complications than classical trabeculectomy with an adequate IOP control (1-3). The success of both techniques is still comparable whenever they are performed in combination with cataract surgery (4).

The use of hyaluronic acid or collagen reabsorbing implants to preserve the intrascleral space increases the rate of surgical success for NPDS (5,6). Such space remains stable during the first three months, but six months after surgery it is partially replaced by fiber tissue among 27% of patients, disappearing completely in 7% of those cases with hyaluronic acid implants after one year follow-up (7). Collagen implants dissolve between 6 and 9 months (8).

Additionally, there are non-reabsorbing implants which have proven their efficacy in the long term to maintain the hypotensor effect (9). Recently, one of the authors (J.C.) developed a new non-reabsorbing implant with 2-Hydroxyethyl Methacrylate (Esnoper®, AJL Ophthalmics, SA, Miñano, Alava, Spain) which, being a non-ionic polymer, shows a very low tendency to build up protein deposits (fig. 1).

Ultrasonic biomicroscopy (UBM) is a bloodless «in vivo» exploration technique which allows visualizing structural alterations caused by filtrating surgery, and used to understand its action mechanisms and the anatomical causes of failure (10,11).

We present herein the UBM studies performed on three patients suffering from NPDS who underwent surgery and received a HEMA implant after one year follow-up.

SUBJECTS, MATERIAL AND METHODOLOGY

Three patients diagnosed with chronic open angle glaucoma with IOP not controlled with topical medication and cataracts were subjected to combined surgery of non-penetrating deep phacosclerectomy (NPDS) and intraocular lens plus Esnoper® implants.

Surgery was performed with retrobulbar anesthesia. The filtrating procedure was done on the top quadrant. After performing a basis conjunctival scrap on the phornix and applying a soft bipolar diathermia on the exposed scleral surface, a 5 x 5 mm scleral flap was dissected from one third of scleral thickness, penetrating 1 mm into clear cornea. Subsequently, a 4 x 4 mm deep triangular scleral flap was dissected, proceeding then to perform a phacoemulsification on the lens with a corneal incision on the right horizontal meridian. A hydrophobic acrylic intraocular lens was inserted (AcrySof®, Alcon, Fort Worth, Texas, USA). Once surgery on the cataract was completed, we proceeded to opening Schlemm’s canal and dissecting the trabeculodescemetic membrane. Afterwards, an «ab externo trabeculectomy» was performed with Mermoud tweezers, excision of the deep flap and placement of the Esnoper® implant underneath the superficial flap, fixing it to the sclera with a 10-0 nylon stitch. Lastly, the superficial scleral flap was sutured with two 100 nylon loose stitches and 2-4 10-0 nylon stitches were applied to the conjunctive, injecting at the end of the procedure a mix of corticoids and antibiotics in the subconjunctival space.

During the period following surgery, patients were treated with an antibiotic and corticoid eye drops (Polypred®, Allergan Inc, Irvine CA, USA) 6 times a day during 4-5 weeks. Ophthalmological checkups were performed during day 1, 7 and 30 and 3, 6 and 12 months, measuring parameters such as visual acuity (VA), IOP, the number of hypotensor drugs, conditions of the filtration ampule and the appearance of post-surgical complications.

At 12 months, a UBM exploration was performed (UBM 840, Zeiss-Humphrey Medical Instruments, 50 MHz) with transversal and longitudinal cuts of the surgical area. In these images we regis-
tered maximum length, width and height UBM in acrylic implant of the intrascleral space, thickness of the trabeculo-descemetic membrane, presence and reflective properties of the filtration ampule, and the presence or absence of a supraciliar hypoechoic area and/or hyporeflective area alongside the intrascleral space. The Esnoper® implant is hyperreflective, allowing for its visualization.

FINDINGS

Table I shows demographic properties and main presurgical variables. None of the three cases presented complications either during nor after surgery.

After a 14-month follow-up, the first patient (case 1) exhibited an improved VA by 0.5 on the eye that had been subjected to a 15 mmHg IOP without further treatment.

Biomicroscopic exploration found the presence of a diffuse and slightly raised ampule with a similar vascularization as the rest of the conjunctiva.

In case 2, after a 1-year follow-up, VA had improved to 0.3, with a 6 mmHg IOP without additional treatment and a flat, diffuse and vascularized ampule.

Fourteen months after surgery, patient 3 exhibited 0.2 VA with a 14 mmHg IOP without any ampules noticeable through biomicroscopy.

Measurements taken from UBM images one year after surgery are shown in table II. In two cases there are hyporeflective areas alongside the intrascleral space, and in one there was also a supraciliar hyporeflective space (fig. 1).

DISCUSSION

One of the undisputed advantages to NPDSs compared to trabeculectomy is a greater safety in relation with its associated low rate of complications (2-4). Furthermore, recent publications point that NPDSs are capable of producing a sustained hypotensor effect (1), specially when using implants to extend the life of the intrascleral space (5,7,9).

We present herein a series of three cases that underwent combined surgery (NPDS) using a new implant made with acrylic non-reabsorbing material. With a small amount of retrobulbar anesthesia (not more than 3 cc), we obtain the adequate level of analgesia and akinesia, which contribute to making surgery more comfortable on patients and easier and safer for surgeons. In all cases, after one-year follow-up IOP was equal or less than 15 mmHg without additional medical treatment. The average percentage decrease for IOPs (45%) may be compared with that reported for other implants (9,12).

Ultrasonic biomicroscopy allows analyzing angle structures after performing filtrating surgery with a clarity similar to that shown by histological studies (10). Previous studies pointed out that the NPDS hypotensor mechanism does not have to be limited to drainage from the intrascleral space to the subconjunctival filtration ampule. NPDS helps creating an intrascleral space separated from the anterior chamber only by the trabeculo-descemetic membra-

<table>
<thead>
<tr>
<th>Case I</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>62</td>
<td>63</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>Female</td>
</tr>
<tr>
<td>Race</td>
<td>Caucasian</td>
<td>Caucasian</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>OAPG</td>
<td>Pseudoexfoliative</td>
</tr>
<tr>
<td>VA</td>
<td>0.3</td>
<td>Counts fingers</td>
</tr>
<tr>
<td>IOP</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>N. of drugs</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

OAPG: Open Angle Primary Glaucoma.

Table II. Ultrasound biomicroscopy features

<table>
<thead>
<tr>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>3.911 mm</td>
<td>3.181 mm</td>
</tr>
<tr>
<td>Radial length</td>
<td>1.318 mm</td>
<td>1.342 mm</td>
</tr>
<tr>
<td>Height</td>
<td>0.357 mm</td>
<td>0.392 mm</td>
</tr>
<tr>
<td>Descemetic membrane</td>
<td>0.122 mm</td>
<td>0.093 mm</td>
</tr>
<tr>
<td>Supraciliar space</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Side hyporeflectant area</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Ampule</td>
<td>Flat hyporeflective</td>
<td>Flat hyporeflective</td>
</tr>
<tr>
<td>Postsurgical IOP (1 year)</td>
<td>15 mmHg</td>
<td>6 mmHg</td>
</tr>
</tbody>
</table>
ne, which can be detected by means of a UBM in approximately 90% of cases.

Beginning with this space, the aqueous humor may filtrate through the thin scleral layer covering the ciliary body and the choroid around the suprachoroid space, or it may be reabsorbed through newly created drainage vessels or drain via the orifices on the Schlemm canal and onto the episcleral vessels.

Although in almost 90% of cases it is possible to detect a filtration ampule after performing NPDS, the majority show flat and diffuse ampules (8,13,14). Marchini et al (7) only found 60% filtration ampules after undergoing NPDS with collagen implants, and their absence did not involve impaired tension control. The type of filtration ampule does not seem to be related either to surgical success (14). The presence of a suprachoroid hyporeflective space revealed by UBMs has been interpreted as a sign of filtration at this level, which was detected in 45 and 60% of patients after undergoing NPDS. Patients showing such suprachoroid space through UBMs presented IOP levels which were significantly lower compared with patients who did not show this sign (7,8,13). Furthermore, the presence of hyporeflective scleral tissue adjacent to the intrascleral space, which could be detected in 47% of cases, seems to result from filtration at this level (7). In this line, in Marchini et al (7) all patients exhibiting the three signs of filtration through UBMs (subconjunctival ampule, supraciliar hypoechogenic area and hyporeflective scleral tissue) were classified as surgical successes.

Through use of a UBM, we could trace in all our patients an Esnoper® implant, maintaining the intrascleral space. All exhibited a conjunctival filtration ampule; patients 2 and 3 also presented a hyporeflectant area adjacent to the intrascleral space, and patient 3 showed a supraciliar hypoechoic area (fig. 2). Measurements of the intrascleral space were similar to those found for other series (7,14).

The patient with the greater decrease of IOP also showed the least thick trabeculo-descemetic membrane (0.093 mm).

Ravinet et al (12) found that the rate of gonipuncture in patients who were recipients of non-reabsorbing implants (T-flux) was greater than that of patients without implants (63.6% vs. 36.4%), although the drop in IOP afterwards was higher (6.1 mmHg vs. 3.35 mmHg). These authors speculated on the possibility that T-flux implants could limit filtration through the trabeculo-descemetic membrane when leaning on it. This hypothesis was reinforced by the fact that gonipuncture proved less effective when performed on the implant.

The new implant is also placed on the trabeculo-descemetic membrane, and could thus interfere simi-
larly in filtration. Nevertheless, the 3 cases presented an IOP lesser than or equal to 15 mmHg after 1-year follow-up without medical treatment nor gonipuncture. In fact, in the UBM images the implant is located inside the intrascleral area without leaning against the trabeculo-descemetic membrane (fig. 3).

In other words, in this initial series HEMA implants show a good tissue tolerance, with no adverse effects observed. Hypotensor efficacy, thanks to preservation intrascleral space, is maintained at least after one-year follow-up. Broader studies are required to confirm the implant’s validity. On the other hand, UBMs are very useful tools in the study of filtration channels for aqueous humors after filtrating surgery.

REFERENCES