BALLON DACRYOCYSTOPLASTY (DCP) FOR TREATMENT OF PEDIATRIC PATIENTS WITH CONGENITAL NASOLACRIMAL DUCT OBSTRUCTION AFTER FAILED PRIMARY PROBING

DACRIOCISTOPLASTIA CON BALÓN CATÉTER EN NIÑOS CON OBSTRUCCIÓN NASOLAGRIMAL CONGÉNITA EN LOS QUE HA FRACASADO EL SONDAJE

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ABSTRACT

Purpose: To determine the efficiency of lacrimal balloon catheter dilatation to treat congenital nasolacrimal duct obstruction in children who had failed two lacrimal system probings.

Methods: Between October 2004 and June 2006 we performed a prospective study of balloon catheter dilatation for congenital nasolacrimal duct obstruction in 30 lacrimal systems. The mean age was 32.4 months (range 18-72 months). The patients were divided into 3 types of obstructions: partial, proximal and simple membranous at the valve of Hasner and into 2 age categories: category 1 (18-36 months) and category 2 (> 36 months). The patients were evaluated 2 weeks, 3 months and 6 months after balloon catheter dilatation, with Munk's score and ophthalmic evaluation using a dye disappearance test being assessed. Clinical patency was defined as a complete resolution of signs and symp-toms (Munk 0) and a negative disappearance test (grade 0).

We used the chi-squared test with Yates´ correction for statistical analysis.

RESUMEN

Objetivo: Analizar el resultado de la dacriocistoplastia con balón catéter (DCP) en niños en los que han fallado dos sondajes previos.

Material y métodos: Entre octubre de 2004 y junio de 2006 se practica DCP en un estudio prospectivo en 30 pacientes con una edad entre 18 y 72 meses (media 32,4 meses) con obstrucción nasolagrimal congénita en los que ha fallado el sondaje en dos ocasiones.

Se estudia el tipo de obstrucción y se diferencia entre estenosis lagrimal, obstrucción proximal y membranosa.

Se dividen dos grupos según la edad menores y mayores de 36 meses.

Se incluye cuestionario con test de Munk y examen oftalmológico incluyendo el test de desaparición de colorante a los 5 minutos efectuados en los controles a las 2 semanas, 3 meses y 6 meses en todos los casos. Se define éxito cuando se normalizaron todos los síntomas y signos (Munk 0) y en el test de desaparición de colorante hay ausencia de tinción residual (Grado 0).
INTRODUCTION

Congenital lachrymal duct obstruction is the most frequent reason for visiting ophthalmologists in patients under 1 year of age (1).

Balloon dacryocystoplasty (DCP) is based on transluminal angioplasty. The catheter was described in 1964 by Dotter and Judkins and used for the first time by Grüntzing and Hooff in 1974 for atherosomatous arterial stenosis. For lachrymal duct pathologies initially an angioplasty balloon was used in adults with epiphora under radiological control. After its use in adults, Becker designed a catheter for children publishing his results in 1991 (2).

The objective of our study is to evaluate DCP in patients who had failed two probings, studying the type of obstruction and patient age.

SUBJECTS, MATERIAL AND METHODS

Between October 2004 and June 2006 a prospective study was conducted of 30 patients who had failed two previous probings and aged between 18 to 72 months.

The failure diagnosis was based on persistent tearing, mucous or purulent secretion, reflux of secretion under digital pressure upon internal canthal region, scabs, agglutination of eyelashes and non disappearance of dye 5 minutes after instilling a drop of 2% fluorescein in conjunctival sac fundus. Epiphora was quantified according to Munk’s scale pre and post-operatively for all patients (table I).

The study did not include patients with dacryocystocele, acute dacryocystitis, dacryocutaneous fistula, injuries in this region, point and canaliculus alterations or cranialfacial alterations.

Patients were classified into two groups by age: group 1 between 18 to 36 months and group 2 aged over 36 months.

After obtaining a verbal and written informed consent from the tutor, DCP was performed under general anesthesia by the same surgeons (AF, AM). A cotton swab with 1% Tetracaine and 1/100,000 Epinephrine was placed in the lower meatus 5 minutes before surgery. After dilating the upper lachrymal point the lachrymal duct was cleansed with saline solution until there were no remains of mucous or purulent secretion. Next, a viscoelastics substance was introduced distinguishing between stenosis or nasolachrymal obstruction depending on...
whether viscoelastics went through lower meatus or not.

By introducing a 0 Bowman probe through point and upper canaliculus the level and type of obstruction can be noted.

A membranous obstruction is defined if when passing the probe a snapping is felt with free rear passage. A more extensive obstruction and proximal to Hasner’s valve produces a firm feeling of obstruction, bone sensation or feeling of probe passing through sandpaper, and repeated steps do not ease this feeling.

We conducted anterograde insertion of a Lacri-cath Balloon Catheter (Quest Medical, Inc. Atrion Company, Allen, Texas) through lachrymal point and upper canaliculus passing it through nasolachrymal sac and duct verifying its correct placement by direct visualization with a 2.7 mm endoscope and 30° with no need for fluoroscopy. Matching upper lachrymal point with catheter proximal marker (fig. 1).

A flexible catheter balloon was used was used of 2 millimeters in diameter (0.60 mm deflated) and 13 millimeters in length for patients aged 30 months or under. A balloon catheter of 3 millimeters in diameter (0.65 mm deflated) and 15 millimeters in length was inserted in patients over 30 months (fig. 2). A hydrostatic pressure pump with manometer for monitoring, similar to those for angioplasty, was connected to the balloon catheter (Quest Medical, Inc. Atrion Company, Allen, Texas).

The balloon was inflated for 90 seconds at a pressure of 8 atmospheres, then it was deflated, which allowed displacing it and placing it proximally at the level of union of the sac with the nasolachrymal duct matching the lachrymal point with the distal marker of the catheter the point being 5 millimeters from the balloon proximal portion and the same sequence of 90-second inflation, 60-second deflation and inflation was repeated at the same pressure. After deflation the balloon was extracted from the lachrymal duct and this was cleansed with saline solution and fluorescein. The fluid normally irrigates easily after dilatation and there should be no resistance. Permeability is confirmed with endoscopic control. The fluid is sucked up with a number 8 tube, a process which also cleans the excretory lachrymal duct.

Average time of the surgery was 7 minutes (range 6-10).

Following surgery we prescribed antibiotic-corticoid eye drops four times a day for 10 days and antibiotic, corticoid and vasoconstrictive pediatric nose drops with 0.025% Oxymethazoline three times a day for five days. We prescribed systemic treatment unless abundant purulent secretion was found when lachrymal duct was cleansed; in this case, Cefuroxime 15 mg/kg/day was prescribed for 1 week.

Patients were evaluated after two weeks, three months and then every 6 months.

The procedure was not repeated in any patient. Follow-up lasted between 6 to 21 months (average 15 months).

At each visit we performed the dye disappearan-
ce test with a drop of 2% sodium fluorescein in each lower conjunctival sac fundus, studying remaining dye after 5 minutes (table II). The tutor was asked about the presence of secretion and epiphora, the latter being quantified with Munk’s test, and we also examined whether there was regurgitation or relaxation of pressure on sac.

Results were classified as good if tearing and mucous-purulent secretion disappeared and dye disappeared from lachrymal meniscus (Munk 0 and dye grade 0), acceptable if tearing improved in more than two grades in Munk’s scale but did not completely disappear and dye persisted after 5 minutes (grade 1 and 2), and poor if outcome was equal to patient’s previous state, improvement was inferior or equal to grade1 in Munk’s scale and dye retention was grade 3 or 4.

The statistical test applied was $\chi^2$ test with Yates’ correction with a confidence level of 95%.

### RESULTS

The surgery was technically performed on 100% of the patients.

All patients were followed-up for over 6 months after surgery (range between 6 to 21 months).

50% of patients had membranous obstruction at Hasner’s valve level during passing of probe. For these patients, outcome was good in 80% of patients, acceptable in 13.33% and poor in 6.66%. One patient presented regression of successful outcome (Munk 0 and dye test 0) at two-week check-up and acceptable (Munk 2 and dye test 1) at three-month visit.

Eight patients had complete lachrymal obstruction, outcome was good in 75% of patients and poor in 25%.

For the seven patients with partial obstruction, we found good results in 100% (fig. 3).

Most relevant observations in this study are that the majority of outcomes regardless of the type of obstruction were considered «good»: in stenosis type obstruction it was 100%; proximal 75% (SE: 30% CI$_{95\%}$: 45% - 100%) and for membranous 80% (SE: 20.24% CI$_{95\%}$: 59.76%-100%).

In this study we obtained $X^2_{exp} = 1.005$ and $X^2_{4,0.95} = 9.4877$, as $X^2_{exp} < X^2_{4,0.95}$, we deduce there is no statistical dependence between the qualitative variables of type of obstruction and results. Therefore the type of obstruction does not influence the outcomes achieved.

As for age distribution, group 1 (patients aged up to 36 months) included 16 patients.

Results in group 1 were good in 81.25% of patients, acceptable in 6.25% and poor in 12.5%.

Group 2 (aged over 36 months) included 14 patients.

Results in group 2 were good in 85.71% of cases, acceptable in 7.14% and poor in 7.14% (fig. 4).

The most relevant observations in this study are that the majority of outcomes regardless of the age of the patients were considered «good»: in group 1 it was 81.25% (SE: 19.12% with CI$_{95\%}$: 62.13%-100%) and for group 2 it was 85.71% (SE: 18.33% with CI$_{95\%}$: 67.38%-100%).

In this other study we obtained $X^2_{exp} = 0.3947$. This value should be compared to $X^2_{2,0.95} = 5.9915$. As it is $X^2_{exp} < X^2_{2,0.95}$, there is no evidence to reject the hypothesis of independence with a confidence level of 95%. Age did not influence outcomes either.

### Table II. Dye disappearance test

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
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<tbody>
<tr>
<td>0</td>
<td>No remaining dye after 5 minutes.</td>
</tr>
<tr>
<td>1</td>
<td>Dye after 5 minutes lower or equal to initial 25%</td>
</tr>
<tr>
<td>2</td>
<td>Dye after 5 minutes between initial 26% to 50%</td>
</tr>
<tr>
<td>3</td>
<td>Dye after 5 minutes between initial 51% to 75%</td>
</tr>
<tr>
<td>4</td>
<td>Dye after 5 minutes between initial 76% to 100%</td>
</tr>
</tbody>
</table>

### Fig. 3: Relation between type of obstruction and outcomes.

### Fig. 4: Relation between patient age and outcomes.
DISCUSSION

Congenital lachrymal duct obstruction affects approximately between 6% and 20% of newborns. Healing is spontaneous in most cases during the first year. For those cases where this is not resolved at one year, an initial probing is effective in 90% of the patients, and with a second probing, in 6% more patients. There is a group of patients who do not respond to probing. Failure risk factors include patient’s age, previous failed probing, false ducts, opening too small, bilateral obstruction, dilated lachrymal sac and non-membranous complete obstructions (3-5).

In those cases where resistance to probing was found, we would initially indicate DCP. Aside from those cases of failed probings, this indication could also be extended as first choice surgery in patients over 2 years of age (3,6,7).

We agree with Chen’s series and Kushner’s comments stating that DCP is probably not indicated for all children, since cases of simple obstruction may respond to probing alone.

In the cases of partial obstruction, Yüksel found a 100% success rate in the four patients treated (6). In our cases there was a healing of the seven patients with permeable duct and epiphora.

Probing only acts in a pointed manner on the obstruction. An important advantage of DCP compared to probing or intubation is the application of enough force along the nasolachrymal duct in a radial and longitudinal manner directly, which leads to greater dilatation.

We performed anterograde balloon insertion as this is a path familiar to the ophthalmologist since it is very similar to probing. This was conducted with endoscopic control which allowed direct visualization avoiding submucous routes and exposure to ionizing radiations such as in the case of retrograde insertion with fluoroscopy (9).

Becker used systemic antibiotics previously to eliminate infection and friability before surgery and to make dilatation more effective. Also, corticoids were used during and after surgery to diminish post-dilatation edema and avoid secondary fibrosis as well as to allow quicker recovery. (2). A controlled study of the balloon with and without systemic medication would be recommendable. In our series we did not use systemic treatment under a protocol.

We found, as Casas and Prat did (1), that patient improvement generally takes place a week after the procedure, perhaps due to the induced post-operative inflammation.

It is very interesting that the results of balloon dilatation are much better in the case of congenital obstruction than in adults, even if it is an incomplete obstruction. In adults regression is the norm as we already communicated at the 15th Congress of the Spanish Association of Ocular and Orbital Plastic Surgery in 2005, Chiclana, Cádiz. This difference can be explained by variations in pathogenesis. In adults, epiphora is usually caused by acquired etiology such as involutional stenosis, inflammation and chronic infection, thus the incidence of secondary stenosis being high given the adhesions and fibrosis of these tissues, unlike congenital cases (9).

Kushner found recurrences in two of the 23 cases when comparing patients at 6 weeks and 2 months (4). Chen found no changes (7).

In our series we found recurrences in one patient. Chen found worse results in children with congenital bilateral obstruction, the possible factors being: reusing the same balloon, older age of these cases or perhaps a bias due to a smaller sample size (7).

Another treatment for patients with CNLDO is silicone intubation which acts as a temporary implant. This is an effective treatment that requires maintaining the silicone tubes in the duct, although this may be associated to complications in up to 20% of the cases including: breakage, loss of the probe and surgical failure (11), corneal erosion and ulceration, repeated conjunctivitis, laceration of lachrymal point, granulomas, stenosis of excretory lachrymal duct (12) and dacryocystitis. Also, insertion and collection of the tube may be difficult in cases with hypertrophy of the inferior cone and abundant mucous content with possible lacerations and iatrogenic synechia (13). Bicanalicular intubation in children may require as well a second general anesthesia to withdraw the tubes, as not removing them may be associated to complications such as obstruction of granulomas and rhinoliths in the nasal cavities.

In our series we found no side effects of DCP. The technical difficulty of its insertion, laceration of lachrymal points and canaliculus has been described.

Goldstein did not observe histopathologic changes after its use and analysis in animal models (14). DCP is a simple treatment to perform, it requires less nasal manipulation as there is no need to introduce pincers or hooks to collect the tubes, thus it reduces the time of surgery, avoiding mucus lacerations and possible synechia, it is well tolerated, it is not associated to the post-operative complications
of bicanalicular intubation and does not require a second operation for its removal, thus reducing costs (15,16).

It is our treatment of choice in cases of failed probing before intubation and dacryocystorhinostomy.

REFERENCES