CONSERVATIVE TREATMENT FOR CONGENITAL NASOLACRIMAL DUCT OBSTRUCTION – FACTORS AFFECTING THE SUCCESS

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Abstract. Aim: To examine the success rate and factors affecting the effect of conservative treatment for congenital nasolacrimal duct obstruction (CNLDO) in children. **Methodology:** A prospective study was made on 167 eyes of 131 patients with clinical signs of CNLDO. All of them were initially treated nonsurgically with Crigler massage. The curative effect of this management was evaluated on the basis of no history of watery eyes, negative regurgitation test, and dye disappearance test 0 or 1 grade. Exploratory analyses assessed whether baseline characteristics including age, gender and laterality were associated with the probability of CNLDO resolving without surgery. If the nonsurgical treatment failed, probing was done in the Eye Clinic in Pleven. **Results:** The conservative treatment for CNLDO with Crigler massage was successful in the majority of treated cases – in 115 out of 167 eyes with CNLDO (68,9%). The remaining 52 (31,1%) eyes were probed. Age ($p = 0,001$) and laterality ($p = 0,001$) were found to be associated with resolution of the clinical signs. **Conclusions:** Nonsurgical management for CNLDO was successful initial treatment in patients with this pathology. The Crigler massage was more effective in children up to 12 months of age with unilateral obstruction.

Key words: congenital nasolacrimal duct obstruction, conservative treatment, Crigler massage

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RECEIVED: 11 August 2020; **REVISED:** 10 October 2020; **ACCEPTED:** 12 October 2020

INTRODUCTION

Congenital nasolacrimal duct obstruction (CNLDO) is found in 6% of newborns [1]. The most common cause for CNLDO is persistence of Hasner's membrane at the distal end of the nasolacrimal duct. The clinical signs in the affected eye are presented with excessive tearing in the first few weeks of life, mucus or muco-purulent discharge especially after sleep, and uninflamed white conjunctiva [2]. The diagnosis is confirmed by dye disappear-

ance test (DDT) which is shown to be very sensitive [3]. There is a chance for spontaneous resolution during the first year of life [4]. However, many cases respond to conservative treatment with lacrimal sac massage [5]. There are two main types of massage techniques: simple and Crigler massage. Simple lacrimal sac massage is performed by gentle inwards pressure applied to the lacrimal sac for 2-3 seconds. It has 66% success rate [6]. Crigler massage is first described in 1923 [7]. It consists of placing the index finger over the common canaliculus to block the exit

of material through the puncta and stroking downwards firmly to increase hydrostatic pressure within the nasolacrimal duct. This provides relief in 94,7% of cases [8]. Some authors have studied the probability of CNLDO resolving without surgery according to age, sex, laterality and prior treatment [6]. If the conservative treatment fails, probing is the first choice of surgical intervention [9].

The aim of this study was to find the efficacy and factors affecting the success of conservative treatment with Crigler massage in patients with symptomatic CNLDO.

MATERIALS AND METHODS

This prospective study was undertaken at the Department of Ophthalmology, University Hospital, Pleven, Bulgaria over a period of 2 years (from January 2017 to December 2018). The protocol for the study was approved by the Committee of the Ethics of Research Activities in the Medical University of Pleven.

Inclusion criteria were patients with a history of watery eyes, positive regurgitation test, and dye disappearance test (DDT) 2 or 3 grade. MacEwen's DDT grading scale was used in our study [10]: *0 grade* – no fluorescein in the conjunctival sac; *1 grade* – thin fluorescein tear strip persists; *2 grade* – fluorescein strip between 1 and 3; *3 grade* – wide fluorescein tear strip. Exclusion criteria were patients with excessive tearing due to reflex tearing secondary to conjunctivitis, intraocular inflammation, epiblepharone, entropion or ectropion, congenital glaucoma, etc. Those criteria were evaluated by the same doctor during the first checkup.

The listed enrollment criteria were met by 131 consecutive patients (167 eyes) with CNLDO. Parents of each child gave written informed consent for the participation in the study. Epidemiological and anamnestic data were collected from them through an interview.

The management protocol for patients with clinical signs of CNLDO involved two steps: lacrimal sac massage and if it failed- probing of the nasolacrimal duct. The conservative management with Crigler massage was performed at home from patients' mothers. While breast-feeding, children were massaged as it seemed to calm the baby. The mother was given step by step guidelines by the treating clinician on how to perform the massage after discharged. Using the tip of the little finger, initial pressure is applied on the lacrimal sac (Fig. 1-A). Then with gentle circulatory movements the mother begins the massage and eventually slides her finger downwards following the nasolacrimal duct (Fig. 1-B). This increases the hydrostatic pressure within the duct and eventually leads to rupture of the membrane. This manipulation shall be repeated 5 times during each session, 5 times a day.

The age group of participants in the study varied between 1-29 months in the beginning of the study. All patients who were less than 12 months old received continuous treatment until the first year of their life. The duration of treatment varied between 1 and 11 months, respectively. In addition, the remaining participants who were over 12 months old received treatment for only up to 3 or 6 months. This mainly depended on the severity of the CNLDO. In cases with mild obstruction such as intermittent epiphora,

A) Pressure over the lacrimal sac

B) Finger slid down the nasolacrimal duct

Fig. 1. The technique of Crigler massage

mucous discharge and 2nd grade of DTT, the massage therapy was recommended up to 6 months. In severe obstruction, with permanent epiphora, purulent discharge and 3rd grade DTT – the treatment was commenced for up to 3 months.

The effect of Crigler massage was evaluated during control examination after the follow-up period. It was successful in cases with no history of watery eyes, negative regurgitation test, and dye disappearance test (DDT) 0 or 1 grade. Exploratory analyses assessed whether baseline characteristics including age, gender and laterality were associated with the probability of CNLDO to resolve without surgery.

If the outcome of conservative therapy was not successful, blind probing was done using a standard technique. The surgical treatment was made in the Eye Clinic, University Hospital, Pleven.

The survey data were statistically processed and analyzed using Microsoft Excel 2010 and Statgraphics Software 2.0.0.0. Statistical analyses were performed with a chi-square test and Student's t-test. A p-value less than 0.05 was considered significant.

RESULTS

In this study, 167 eyes of 131 patients with clinical signs of CNLDO were followed-up, after excluding other causes of watering. Out of them, 115 (68.9%) eyes of 91 children were successfully treated with Crigler massage (Fig. 2). The mean follow-up period was 3 months (from 1 to 13 months). Probing was done in 52 (31.1%) eyes who did not respond to non-surgical management.

Success rate of conservative treatment

Fig. 2. Overall success rate of conservative treatment for CNLDO. 115 (68.9%) eyes of 91 children were successfully treated with Crigler massage (shown in green color); probing was done in 52 (31.1%) eyes (shown in red color)

The CNLDO was totally resolved in 43 (47.3%) male and 48 (52.7%) female patients within the noninvasive treatment. There were no statistically significant differences in the success rate of Grigler massage according to the gender ($t = 0.57$, $p > 0.05$).

The median age of infants who were successfully treated with conservative treatment at the time of the initial examination was 5.0 months (ranging from 1.0 to 29.0 months). Age at recovery ranged from 2.0 to 35.0 months (10.0 months in median). Children were divided into two age groups depending on their age at healing: up to and above 12 months old. Treatment with Crigler massage was successful in 82 (77.4%) eyes of 69 children up to 12 months old and was without effect in 24 (22.6%) eyes of 19 children. In children above 12 months old the conservative treatment was with curative effect in 33 (54.1%) eyes (22 children) and had no effect in 28 (45.9%) eyes (21 children) (Fig. 3).

Fig. 3. Distribution of 167 eyes of children with CNLDO in the two age groups according to the presence of a successful result of conservative therapy

The conservative treatment was more successful in children up to 12 months of age ($\chi^2 = 9.45$; $Df = 1$; $p = 0.002$).

The participants in the study were divided by laterality of CNLDO. There were 95 (72.5%) unilateral and 36 (27.5%) bilateral cases. Recovery with the conservative approach was observed in 75 (78.9%) patients with unilateral CNLDO. This method of treatment was unsuccessful in the remaining 20 (21.1%) patients with unilateral CNLDO. In bilateral CNLDO, successful cure with massage was observed in 55.6% and treatment was not successful in 44.4% of the treated eyes (Fig. 4).

Fig. 4. Distribution of 167 eyes with unilateral and bilateral CNLDO according to the presence of a successful result of conservative therapy

The successful effect of lacrimal sac massage was more common in unilateral than in bilateral CNLDO ($\chi^2 = 10.45$; Df = 1; $p = 0.001$).

DISCUSSION

The conservative therapy with lacrimal sac massage is the first choice of treatment in newly diagnosed cases with CNLDO [11]. According to the literature, the success rate of Crigler massage is between 82.9% and 94.7% [2, 8, 11, 12]. In our study, the effect of Crigler massage was studied in consecutive patients with clinical signs of CNLDO who were at different ages at the beginning of the research. The overall success rate of the nonsurgical treatment was 68.9%. This percentage is smaller than the success rate cited by other authors because of limitations in their methodology, which increases their success rate. The children included in the cited researches were with fixed age at the time of completion of the treatment (between 6 and 13 months of age) [2, 8, 12]. Other authors did not use dye disappearance test (DDT) to validate the outcome of the conservative treatment [11]. MacEwen and Young concluded that DDT provides objective and comparative data on the lacrimal outflow status [10].

Some researchers studied the factors affecting the success rate of conservative treatment for CNLDO [6,13]. Our exploratory analyze of the influence of gender on the outcome of conservative treatment did not find such dependence ($p > 0.05$). The PEDIG study [6] also did not find gender to be associated with cure without surgery.

The effect of conservative therapy depends on the age of the children. Katowitz et al. reported that the success rate in those up to 13 months of age was high and significantly decreased in patients up to 24 months, and after this age conservative therapy was ineffective [13]. In this study we found that children up to 12 months of age were more susceptible to massage treatment than those after 12 months of age ($p = 0.001$) and this difference was statistically significant. Based on these results, we recommended Crigler massage to be applied in newborns with CNLDO until the age of 1 year. Nevertheless, in single studies spontaneous resolution was noted in children over 2 years of age [14]. We also found successfully treated with lacrimal sac massage cases in children after 12 months of age. The presence of such patients, despite their small number, made it possible to postpone surgical treatment in mild cases of CNLDO, when the parents did not want surgical treatment at an earlier stage. The duration of conservative treatment should be taken into account to the severity of the disease and the risk presence of complications if probing is delayed.

Congenital nasolacrimal duct obstruction is usually unilateral. In bilateral cases the symptoms are com-

monly asymmetrical [11]. The PEDIG study [6] examined the effect of nonsurgical treatment applied for 6 months in unilateral and bilateral cases of CNLDO. They found no statistical relationship between the effectiveness of the simple massage and the affected eye. According to our results the unilateral cases were more susceptible to conservative treatment ($p = 0.001$). We believe that the reluctance of parents to wait for a possible successful outcome in bilateral cases was the determining factor. Chronic tearing and discharge from both eyes was the reason parents would prefer the surgical method of treatment, which would solve the problem in the short term.

CONCLUSIONS

Congenital nasolacrimal duct obstruction was treated gradually: first conservatively and then surgically if necessary. The nonsurgical treatment with Crigler massage was highly effective. Factors that affected the success rate of this procedure were the age of the patient and the laterality of the disease. Crigler massage was more effective in children up to 12 months of age with unilateral obstruction.

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