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Original Article

The importance of scintigraphic qualitative and quantitative measurements in patients with epiphora due to unilateral punctum stenosis

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Abstract

Aim: We aimed to evaluate nasolacrimal drainage and accompanying additional occlusions after topical steroid treatment in punctal stenosis patients with recurrent epiphora. We evaluated the change in nasolacrimal drainage and the effect of the presence of additional pathology on the response to noninvasive medical treatment in the 6-month follow-up after treatment.

Materials and Methods: Fifty-two patients with unilateral punctal stenosis and ipsilateral epiphora were included in our study. The mean age of the patients was 68.23±9.67. All patients received topical steroids for punctal stenosis. Dacryoscintigraphy was performed on all patients to evaluate additional pathologies before treatment. In the pre-treatment dacryoscintigraphy, there was obstruction at the lacrimal sac entrance in 7 (13%) patients, at the sac outlet in 24 patients (46%), and in the nasolacrimal duct in 21 patients (40%). Dacryoscintigraphy was repeated 6 months after treatment to evaluate the response to treatment. None of the patients had a history of surgery for the punctum or nasolacrimal system. Ophthalmological examination findings were normal on the non-complaining side. Dacryoscintigraphy on both sides was performed. Scintigraphic images were evaluated both quantitatively and qualitatively. Regions of interest were plotted on specific areas for quantitative evaluation.

Results: Thirty-four (81%) patients were female. The punctal region had an edematous appearance in patients with punctal stenosis. Dacryoscintigraphy was repeated 6 months after the treatment to evaluate the response to the treatment. Nasolacrimal drainage was normal in 71% of patients who had stenosis at the entrance and exit of the sac as a result of punctal stenosis treatment. Epiphora and stenosis at the same level persisted in all 21 patients with nasolacrimal duct stenosis.

Conclusion: Punctal stenosis is a common condition, especially in elderly patients. Methods with excellent patient compliance in diagnosis and treatment should be preferred first. Dacryoscintigraphy is a convenient method to identify patients for whom aggressive methods are required.

Keywords: Punctal stenosis, dacryoscintigraphy, lacrimal drainage system, epiphora

INTRODUCTION

The lacrimal drainage system (LDS) consists of the upper and lower punctum, canaliculi, lacrimal sac, and nasolacrimal duct (1). Punctal stenosis (PS) is more common in the inferior punctum. The eyelid secretion system consists of tear glands of various sizes (1,2). In tear secretion, some mechanisms work together. One of them is conjunctival evaporation. Others are reabsorption from the conjunctiva, canaliculi, and sac, and excretion from the nasolacrimal duct (2). Muscle contractions, capillaries, and blinking movements help these mechanisms (1). In some localizations, some valves prevent the reflux of tears. In patients with epiphora complaints, the diagnosis of PS is made during the eye examination performed with the biomicroscopic method.

Dacryoscintigraphy (DSG) is a physiological method and is preferred in the evaluation of lacrimal drainage. Other advantages of DSG are low radiation exposure and short examination time. It also allows bilateral evaluation of lacrimal drainage. In patients

with PS, nasolacrimal duct stenosis is also possible. Distal stenosis causes epiphora complaints to persist despite local treatment of PS, and thus treatment failure. Repetitive surgical dilatation of the punctum is the cause of iatrogenic strictures. For this reason, it should be known whether there is distal stenosis in addition to PS in patients with epiphora complaints.

Low resolution and insufficient anatomic localization are disadvantages in visual quantitative evaluation with DSG (1). DSG is a suitable imaging modality for the evaluation of postoperative surgical success as well as preoperative evaluation (2). The addition of scintigraphic quantitative data to visual data will increase the success of treatment, especially in patients with PS. In addition to PS, stenosis areas detected will contribute to the determination of the treatment method. Thus, repetitive surgical dilatations will not be required, and iatrogenic strictures will be prevented.

In this study, it was aimed to evaluate nasolacrimal drainage and accompanying additional occlusions before and after topical steroid therapy in patients with PS with recurrent epiphora. In our study, we evaluated the effect of the presence of additional pathology on the response to noninvasive medical treatment in the 6-month follow-up after treatment.

MATERIALS AND METHODS

Our study included 52 patients with unilateral PS and ipsilateral epiphora. In our retrospective study, all of our patients were examined in ophthalmology outpatient clinics before imaging, and their scintigraphic examinations were obtained between 2017-2023. All patients received topical steroid therapy for PS. Before treatment, all patients underwent DSG to evaluate additional pathologies. In DSG performed before treatment, there was obstruction at the lacrimal sac entrance in 7 patients (13%), at the sac outlet in 24 patients (46%), and in the nasolacrimal duct in 21 patients (40%). DSG was repeated 6 months after treatment to evaluate response to treatment. None of the patients had a history of surgical intervention on the punctum or nasolacrimal system. Eye examination findings were normal on the non-complaining side. DSG was performed on both sides. Scintigraphic images were evaluated quantitatively and qualitatively. Regions of interest were plotted in specific areas for quantitative evaluation. The complaints were unilateral in the patients. Ophthalmological examination findings were also normal on the non-complaining side. None of the patients had a history of nasolacrimal operation. No interventional treatment was applied to patients with epiphora complaints. Several patients had a history of using antibiotic eye drops. The epiphora complaint of the patients had continued for at least 6 months. Thirty-four (81%) of the patients were women. The mean age of the patients was 68.23±9.67 years.

The standard method was used for scintigraphic imaging (3-10). Before the installation of radioactive material, the patient was placed on his back. Thus, artifacts that may result from the outflow of active tears are minimized. A lacrimal sac massage was applied to the eye with PS. The tears around her eyes dried up. A 10 µl volume of 100 µCi Tc-99m pertechnetate was dropped into both eyes. Dynamic and static images were obtained. Dynamic images were recorded every 4 seconds for a total of 30 images. Static images were acquired 5, 10, and 15 minutes after dynamic imaging. A 3.25 zoom was used on a 128x128 matrix (Figure 1). Images were acquired using a low-energy, high-resolution collimator on a Siemens E-cam dual-head gamma camera. The eyes of the patient, whose procedures were completed, were washed with physiological saline. Thus, the radioactive drug remaining on the surface of the eye was removed from the eye. It was aimed to reduce the radiation dose to which the eye is exposed. Regions of interest (ROI) of specific areas were plotted for quantitative evaluation (2). ROIs were drawn bilaterally in four different areas (Figure 2). Average counts (total counts/pixel area) were recorded. Our study was approved by the Gaziosmanpasa Training and Research Hospital Clinical Research Board on 07.07.2021 with document number 301.

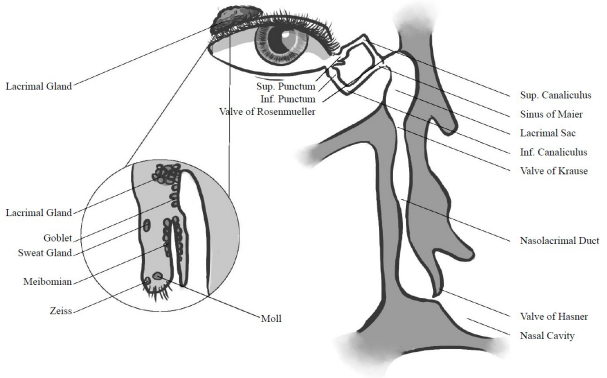

Figure 1. Drawing of the secretory and excretory system of the right eye and showing the stenosis in the drainage system

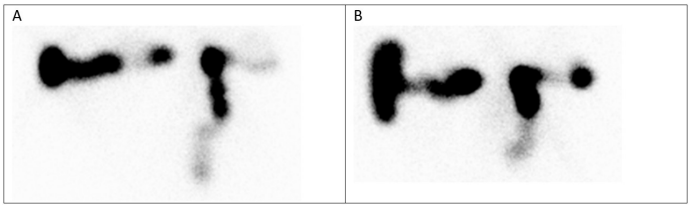

Figure 2. In a patient with epiphora on the right side, **A.** Before topical steroid treatment **B.** Continuing obstruction at the entrance of the lacrimal sac after

Statistical Analysis

Statistical analysis was performed using SPSS version 21 software. Data were given with crosstabs according to percentiles.

RESULTS

Forty-two (81%) of the patients were women. The mean age of the patients was 68.23±9.67 years. In patients with PS, the punctal region had an edematous appearance. DSG was repeated 6 months after treatment to evaluate response to treatment. As a result of the treatment for PS, nasolacrimal drainage was normal in 71% of the patients who had stenosis at the entrance and exit of the sac. Epiphora and stenosis at the same level continued in all 21 patients with stenosis in the nasolacrimal duct. The findings are summarized in Tables 1-2.

Table 1. Normal drainage rate in dacryoscintigraphy performed 6 months after topical steroid treatment

	Stenosis at the entrance of the lacrimal sac (n: 7)	Stenosis at the exit of the lacrimal sac (n: 24)	Nasolacrimal duct stenosis (n: 21)
Reporting rate of normal drainage after treatment	5/7 (71%)	17/24 (71%)	0/21 (0%)

Table 2. In patients with unilateral epiphora, mean counts (total count/pixel area) were obtained from dacryoscintigraphy images of the contralateral side (with lacrimal drainage within normal limits) and areas of interest for drainage normalized after topical steroid therapy

	ROI-1 median (min-max)	ROI-2 median (min-max)	ROI-3 median (min-max)	ROI-4 median (min-max)
Lacrimal drainage within normal limits	1.84 (1.79-1.87)	20.58 (18.71-23.82)	4.53 (4.12-4.78)	2.17 (2.01-2.23)
Quantitative values in patients normalizing after topical steroid	1.82 (1.77-1.85)	22.72 (21.81-24.01)	3.98 (3.21-4.11)	2.21 (2.07-2.29)

DISCUSSION

DSG is a non-invasive imaging method that does not disrupt the physiology of the lacrimal system. The radiation dose to the eye is 0.014-0.021 rad. In the case of complete occlusion, this dose can be 0.4-0.6 rad (2). It has been reported that there is no difference between lying and sitting positions in terms of tear drainage (3). Radioactive drugs were administered to our patients in the supine position. Impaired tear drainage is an uncomfortable condition. However, it also threatens eye health. Recurrent eye infections are common in these patients (4). The tears accumulating in the sac form a suitable environment for the reproduction of many microorganisms, especially pneumococci. Visual acuity also decreases in the presence of epiphora. It has been reported that patients wipe their eyes approximately every 6 minutes during the day (4). Many factors are blamed in the etiology of epiphora. Punctal stenosis, turbinate nasal hypertrophy, disorders due to atrophic rhinitis, and septum deviation are some of these causes. Sometimes several factors can coexist. Determining the factors that cause epiphora and clarifying the degree of obstruction increase the success of treatment (5,6). PS and epiphora are common in the elderly population. Epiphora recurs in some patients treated with topical steroids. Occlusions at other levels of the nasolacrimal drainage system frequently accompany PS. These additional disorders result in relapse or inadequate treatment of epiphora. Our study shows that PS treatment does not prevent epiphora in the presence of distal nasolacrimal duct obstruction. In the presence of more proximal additional occlusion, a 71% improvement was detected. Presumably, topical steroid therapy for PS also affects the proximal regions. Since the volume of tears conveyed to the nasolacrimal duct will increase after PS treatment, improvement can be achieved with the volume effect in other regions. Epiphora can be caused by multifactorial causes, and eliminating one factor reduces the complaint. DSG is also valuable in the postoperative follow-up of patients (5). PS-induced epiphora is more common in females. The narrow lumen in the bony part of the tear lumen in women and the fact that the vascular plexus in the membranous part is affected by hormonal periods in women contribute to the appearance of the complaint (4). In our study, the number of female patients was also high. All of our female patients were in the menopausal period. Punctal edema and eyelash defects may be noticed on eye examination (7). All of our patients have unilateral punctal stenosis and epiphora on the same side. Considering that punctal stenosis is a functional stenosis, it is recommended to question whether there is an additional dysfunctional disease before starting treatment. Thus, a more careful interpretation of the tests is provided (7). Proximal and distal partial occlusions may accompany ocular surface diseases (8-10). The development of minimally invasive surgical methods in recent years has led to less preference for aggressive operations. In one study, it was reported that DSG was superior to DCG in detecting middle canal stenosis (10). Patient compliance in DSG is quite good. It can be used for screening purposes in familial diseases where epiphora is common and in the elderly population (10). Dacryocystorhinostomy (DSR) is a method that is applied in post-sac obstructions and provides a connection between the lacrimal sac and the nasal cavity. Preoperative determination of the occlusion level increases the success of both minimally invasive methods and DCR. The radiation dose to which the optical lens is exposed in DSG is much less than in DCG (5). In the patient group whose epiphora continued after DCR, the sensitivity was calculated as 100% in detecting the disorder with DSG. In our study, ROI was drawn in four different areas bilaterally. DSG has been evaluated qualitatively and quantitatively (11,12). It has been reported that the tear transition period is 0.5-10 minutes in normal individuals (13,14). In our study, all of our patients were diagnosed with PS using the biomicroscopic method. The incidence of PS is approximately 17.3% (15,16). Stenosis is mostly seen in the inferior punctum (16-18). Despite treatment, 1/3 of patients with PS continue to complain of epiphora (19). In our study, DSG was evaluated visually and quantitatively in patients with stenosis in different localizations other than PS. There are studies conducted by drawing ROI on the conjunctiva and nasolacrimal canal (5). Repeated punctal dilation and nasolacrimal lavage can cause iatrogenic PS (19). Evaluation of the nasolacrimal drainage system before DSG treatment in patients with PS will reduce

repetitive interventions. It has been reported that only 39.6% of patients with PS have intact canaliculi (20-22). In cases where functional and anatomical defects coexist, punctoplasty may be required (22-24). Accumulation of radioactive material in the medial conjunctival sac in DSG makes it difficult to visually separate the medial canthus from the lacrimal sac (9-25). This deficiency can be avoided by adding quantitative analysis. In our study, quantitative analysis was also performed. In recent years, minimally invasive procedures such as endoscopic DCR and transcanalicular diode lasers have been preferred (26-31). DSG is also useful in assessing the success of these techniques (32-37).

Work Limitations

A retrospective is the weakness of our study.

CONCLUSION

PS is a common condition, particularly in elderly patients. Methods with excellent patient compliance in diagnosis and treatment should be preferred first. DSG is a suitable method to identify patients for whom aggressive methods are required.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
Our study was approved by the recorded Committee of Clinical Research at Gaziosmanpasa Training and Research Hospital with document number 301 on 07.07.2021.

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