

The clinical value of dacryoscintigraphy in the selection of surgical approach for patients with functional lacrimal duct obstruction

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Purpose: Dacryoscintigraphy is widely known to be an effective modality in diagnosing abnormalities of the lacrimal system that cause epiphora (pathological overflow of tear). However, dacryoscintigraphy rarely serves beyond the simple diagnostic use for lacrimal duct obstruction. In our study, dacryoscintigraphy results of patients with functional lacrimal duct obstruction are newly classified into three types, the effects and prognoses of silicone tube intubation are noted according to each type, and the role of dacryoscintigraphy in determining appropriate surgical approaches is evaluated. **Methods:** Subjects were 36 eyes of 29 patients complaining of epiphora who had increased tear meniscus, but showed no sign of obstruction on duct syringing. Impression of functional lacrimal duct obstruction was made through dacryoscintigraphy, and silicone tubes were inserted. **Results:** Patients were classified according to the results of dacryoscintigraphy; those with delayed secretion in the distal nasolacrimal duct were typed as class I; those with delays in the proximal nasolacrimal duct class II; and delayed secretion from the pre-lacrimal sac to the lacrimal sac as class III. All patients had silicone tube intubations together with selective punctoplasty. Symptomatic improvement was observed in all 6 cases of distal nasolacrimal duct obstruction (100%), 14 of 18 proximal obstruction cases (77.8%), and 8 of 12 pre-lacrimal obstructions (66.7%). **Conclusions:** Functional lacrimal duct obstruction is easily diagnosed with dacryoscintigraphy. Furthermore, it may be classified by types of obstruction to predict post-operative results of silicone tube insertion. Cases suspicious of pre-lacrimal sac obstructions in particular may achieve better operative results with adjuvant treatments in addition to silicone tube insertion.

Key words: dacryoscintigraphy, functional nasolacrimal duct obstruction, silicone tube intubation

INTRODUCTION

EPIPHORA, or pathological overflow of tear, is a common symptom encountered in ophthalmology and is usually due to an obstruction of the lacrimal excretion system. Other causes include xerophthalmia, foreign bodies, and drug induced tear overproduction. Patients who complain of epiphora without tear overproduction, but show easy

passage on syringing are said to have functional lacrimal duct obstruction. This delayed or absent excretion of tears without anatomical obstruction of the lacrimal system is caused by stenosis of the lacrimal system, aberrant punctum location or blocked flow through the punctum, and dysfunction of the lacrimal excretion pump.¹⁻³

Dacryoscintigraphy, first introduced by Rossomondo et al. in 1972, is widely employed in diagnosing abnormalities of the lacrimal system.⁴ The procedure is easy to perform and noninvasive, but being primarily a diagnostic modality, its use has greatly declined nowadays as treatment tends to start directly after only an ophthalmological examination. We newly classified functional lacrimal duct obstruction according to the dacryoscintigraphy results, performed silicone tube intubations, and compared

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the preoperative and postoperative states in each case. We sought to evaluate the possible clinical role of dacryoscintigraphy in predicting the surgical outcome.

MATERIALS AND METHODS

Subjects

Subjects were 36 eyes from 29 patients complaining of epiphora (age: 44–80 years, mean age: 54.6 years) who visited St. Mary Hospital between October 1999 and March 2004, and had silicone tube insertions after dacryoscintigraphy under suspicion of functional lacrimal duct obstruction, showing no obstruction on duct syringing but increased tear meniscus.

On initial evaluation, the patient were interviewed for medical history and any existing systemic illness, had their visual acuity and ocular pressures measured, and were examined by split lamp microscopy. Any ophthalmological diseases, and the location and size of the punctum were observed. Also, tear break up time and tear meniscus were measured, and syringing was performed after Schirmer test. Patients with dysfunctional lacrimal pump function, such as excessive laxity of the eyelid or paralysis of the orbicularis oculi muscle, those with aberrant location or complete blockage of punctum, and with diseases affecting tear secretion such as keratitis or conjunctivitis were excluded.

Images and Analysis
Dacryoscintigraphy was done in all patients. Patients were seated in front of the pinhole collimator of the gamma camera, and after applying 0.1 ml of Tc-99m pertechnetate of 1.85–3.7 MBq (50–100 μ Ci) in the lateral portion of each eyeball we recorded bilateral eyeball images at 2 minute intervals for 30 minutes.

Images and Analysis

When the radiotracer flowed from the conjunctival sac to the nose, the case was considered normal, and when it failed to reach the nose, the case abnormal. Subsequently, the abnormal results were classified into three types. Class I is delayed excretion in the distal nasolacrimal duct, when flow from the lower nasolacrimal duct and nasal cavity is late. Delays in the proximal nasolacrimal duct, showing early tracer appearance in the lacrimal sac and delayed excretion into the nasolacrimal duct is class II. And

Class III is delayed excretion in the pre-lacrimal sac, when flow from the lower nasolacrimal duct and nasal cavity is late. Delays in the proximal nasolacrimal duct, showing early tracer appearance in the lacrimal sac and delayed excretion into the nasolacrimal duct is class II. And

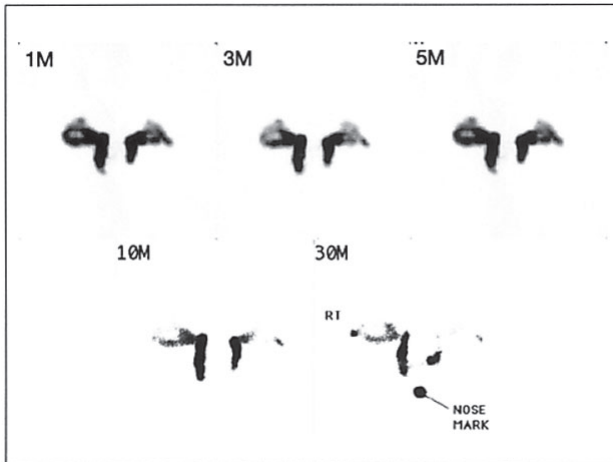


Fig. 1 Dacryoscintigraphy in Type I (delay at distal nasolacrimal duct, both eye). Interpalpebral fissure, lacrimal sac and nasolacrimal duct were filled with tracer with little change at 1 minute and 5 minutes after instillation in both eyes. This state was sustained for 30 minutes.

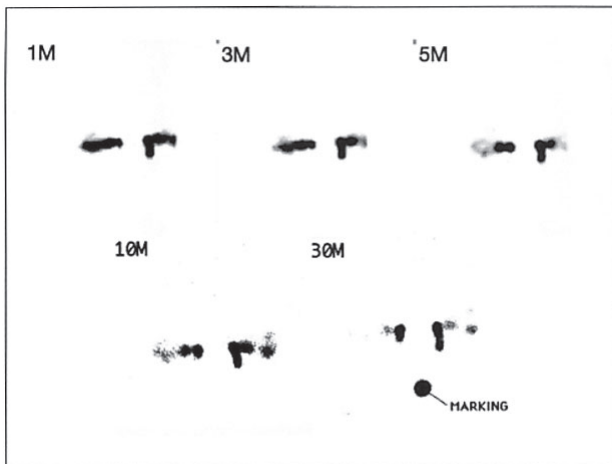


Fig. 2 Dacryoscintigraphy in Type III (delay at pre-lacrimal sac, right eye) and Type II (delay at proximal nasolacrimal duct, left eye). The tracer filled the interpalpebral fissure in the right eye. And as time passed, the tracer was seen to collect in the medial canthus in the right eye. In the left eye, tracer filled the interpalpebral fissure and lacrimal sac, but no tracer was seen in the nasolacrimal duct. This state was sustained for 30 minutes without significant change.

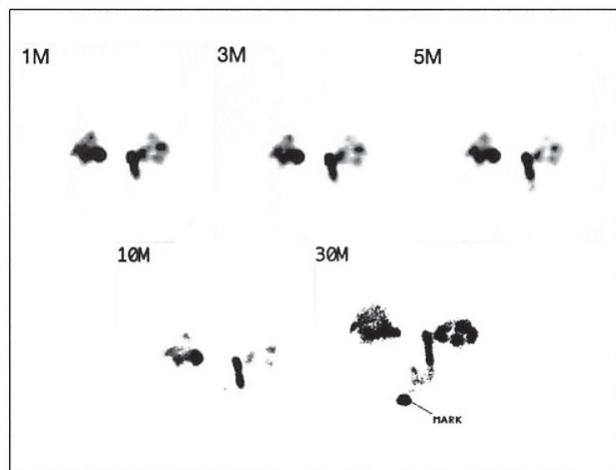


Fig. 3 Dacryoscintigraphy in Type III (delay at pre-lacrimal sac, right eye) and normal Type (left eye). In right eye, tracer filled the interpalpebral fissure and some tracer was found pooling in the inferior fornixes at 1 minute and 5 minutes after instillation. This state was sustained for 30 minutes. In the left eye, dacryoscintigraphy showed a normal appearance. The tracer was diminished in the interpalpebral fissure as time passed.

Table 1 Variables in different types of functional nasolacrimal duct obstruction

	Age (years)	Sex (Male/Female)	Punctoplasty	Follow up period (months)
Type I (6 eyes)	52	1/5	3	13.4
Type II (18 eyes)	52.9	9/9	14	14.6
Type III (12 eyes)	55.4	2/10	11	12.8
Total	54.8	12/24	28	13.8

Type I: delayed excretion distal to the nasolacrimal duct

Type II: delayed excretion proximal to the nasolacrimal duct

Type III: delayed at pre-lacrimal

Table 2 Result of silicone tube intubation in different types of functional nasolacrimal duct obstruction

	Improved*	Partially improved [†]	Stationary [‡]
Type I (6 eyes)	6 eyes (100%)	0 eyes (0.0%)	0 eyes (0.0%)
Type II (18 eyes)	14 eyes (77.8%)	1 eyes (5.6%)	3 eyes (16.7%)
Type III (12 eyes)	8 eyes (66.7%)	1 eyes (8.3%)	3 eyes (25%)

* Improved: under +2 in dye disappearance test and complete improvement of symptoms

[†] Partially improved: under +2 in dye disappearance test but remaining epiphora

[‡] Stationary: over +2 in dye disappearance test

delayed excretion from the pre-lacrimal sac to the lacrimal sac, demonstrating delayed excretion into the lacrimal sac with tracers distributed throughout the entire medial palpebral fissure is class III.

Surgery

All patients underwent silicone tube insertion (BIKA[®], Bicanalicular intubation set, S1.1000, FCI, France), and concomitant punctoplasty was performed (1, 2 snip) in 28 eyes. Follow up exams were made 1 week, 1 month, 3 months, and 6 months after the operation, and the postoperative follow up period was 6–43 months (mean 13.8 months). Silicone tube removal was done under rhinoscopy 6 months after the operation in the out patient department. During follow up exams, operative results were assessed by improvement of epiphora symptoms and dye disappearance test. From the two positives on the dye disappearance test, we are able to conclude that a partial or complete obstruction, or pump failure might be present. Therefore, complete improvement of symptoms and results less than two positive on the dye disappearance test was considered to be successful. Non epiphora and over two positive in the dye disappearance test was considered to be partially successful, and no symptomatic improvement and over two positive in the dye disappearance test was considered a failure.

RESULTS

In pre-operative dacryoscintigraphy, 6 patients had eyes with delayed secretion in the distal nasolacrimal duct (Type I). The mean patient age was 52 years, the mean post-operative follow up period was 13.4 months, and

concomitant punctoplasty was performed in 3 eyes. All 6 eyes showed symptomatic improvement (Fig. 1).

There were 18 cases, with delayed secretion in the proximal nasolacrimal duct and lacrimal sac (Type II). The mean age was 55.1 years, and the mean postoperative follow up period was 14.6 months. Concomitant punctoplasty was performed in 14 eyes. Fourteen of the 18 eyes showed complete symptomatic improvement, one showed partial improvement, and 3 cases showed no symptomatic improvement (Fig. 2).

There were 12 cases with delayed secretion into the lacrimal sac (Type III). The mean age was 54.8 years, and the postoperative follow up period was 12.8 months (Table 1). Eight of 12 eyes showed complete symptomatic improvement (Figs. 2, 3). Operative success rate was highest in type I group, and lowest in type III (Kruskall-Wallis test, $p < 0.05$) (Table 2).

DISCUSSION

Causes of epiphora can be broadly classified into tear overproduction and lacrimal excretion dysfunction, and the latter can be further divided into anatomical obstruction and functional obstruction. Functional obstruction is delayed or blocked tear excretion in the absence of mechanical obstruction of the lacrimal excretion system, and its causes can be categorized into stenosis of the lacrimal excretion system, anomalous location or blockage of the punctum, and dysfunction of the lacrimal pump.¹⁻³ Differential diagnosis may be made through various modalities such as history taking, syringing, nasolacrimal probing, tear break up time test, Schirmer test, Jones dye test, dacryoscintigraphy, dacryocystography, digital

subtraction dacryoscintigraphy, and computed tomography.

Diagnosis of functional lacrimal duct obstruction in the OPD can be made by using the Jones dye test. However, test results may vary according to the relative experience of the examiner, and the patient may experience discomfort. Although the Jones dye test is known to provide a more accurate diagnosis than dacryocystography, it requires the insertion of a tube into the nasolacrimal duct to shoot the dye and thus is more invasive, demands patient cooperation, and tends to distort the location and cause of duct obstruction.⁴

In comparison, dacryoscintigraphy provides relatively objective data on functional duct obstruction and yields more detailed results in cases of partial obstruction.⁵⁻⁸ Hanna et al. reported that in 65% of patients suspected of having functional duct obstruction, 33% showed nasolacrimal duct obstruction, 25% lacrimal sac obstruction, and 7% decreased flow from the palpebral fissure to the lacrimal excretion system.⁹ Wearne et al. reported that from 95% of patients suspected of functional duct obstruction, 13% had pre-lacrimal sac obstruction, 35% pre-nasolacrimal duct obstruction, and 47% intra-nasolacrimal duct obstruction.⁵ In our study there were six of type I eyes (17%), 18 type II eyes (17%) and 12 type III eyes (33%). This result is attributed to the fact that cases with clear causes, including dysfunctional pump system such as palpebral laxity or facial palsy and aberrant punctum location, were excluded from the study.

Treatment of functional lacrimal duct obstruction includes punctoplasty in cases of punctum stenosis, blepharoplasty in eyelid laxity or ectropion, and in cases of partial lacrimal duct obstruction, silicone tube insertion, employment of dacryocystorhinostomy, and conjunctivodacryocystorhinostomy.¹⁰⁻¹⁴ Among these modalities, silicone tube intubation is easy to perform and gives minimal discomfort and pain to the patient. However, post-operative symptomatic improvement results are inferior to those of conjunctivodacryorhinostomy. Dacryorhinostomy is highly successful but must be performed in the OR, is invasive, and causes significant discomfort and pain to the patient. This study analyzed the relationship between the types of dacryoscintigraphy and the postoperative results of respective types, and evaluated its role in choosing appropriate surgical methods.

This study newly classified the findings of the dacryoscintigraphy according to the region of obstruction in functional lacrimal duct obstruction patients. Silicone tube intubation was performed in each of the patients, and then the surgical results were reviewed. The low surgical success rate in cases of pre-lacrimal sac obstructions (group III) is most likely caused by inflammation of the lacrimal sac that existed even before the operation. Because silicone intubation was carried out without correction of the inflammation, infection of the lacrimal sac occurred after the surgery and resulted in anatomical

obstruction. The operation failures in groups I and II probably resulted from blepharochalasis or abnormality of the lacrimal pump function. In other words, the differences in the operational success rates probably resulted from the difference in the accompanying abnormalities specific for each group.

From the cases in which silicone tube intubation was not successful, both of the cases that showed partial improvement had mild eyelid laxity, and of the 6 cases that showed no improvement, one had moderate eyelid laxity that was not corrected. Thus we inferred that silicone tube insertion may correct partial lacrimal duct obstruction but cannot correct lacrimal pump dysfunction. In pre-lacrimal sac obstruction cases (Type III), all three cases that showed no improvement developed dacryocystitis 1-2 months after operation, and symptoms worsened in all three cases owing to anatomical lacrimal duct obstruction. Concomitant punctoplasty or correction of lid laxity along with silicone tube intubation and appropriate prophylaxis and treatment against dacryocystitis after surgery may significantly improve success rates for pre-lacrimal sac obstruction as well, and silicone tube insertion may be considered before dacryocystorhinostomy. Operative success rates of distal nasolacrimal duct obstructions identified by dacryoscintigraphy were 100% (6/6). Although the number of subjects was small, distal duct obstructions may be attributed to Hassner valve stenosis or temporary obstruction, and in such cases silicone tube insertion may be effective. In proximal nasolacrimal duct obstruction, operative success rates were 77.8% (14/18) and partial success rates were 5.6% (1/18). Distal duct obstruction is thought to be a result of stenosis in the region connecting the lacrimal sac and nasolacrimal duct, and silicone tube insertion may also be effective in these cases.

CONCLUSION

In conclusion, by performing dacryoscintigraphy prior to surgery in functional lacrimal duct obstruction cases, the postoperative results of silicone tube insertion could be predicted according to the location of stenosis. Dacryoscintigraphy can guide the surgeon in choosing the surgical method with the best outcome for functional lacrimal duct obstruction cases, and presents a new clinical significance. Therefore, dacryoscintigraphy should become the first-line examination in functional lacrimal duct obstruction patients.

REFERENCES

1. Jeffery A. Nerad: Oculoplastic Surgery. St. Louis; Mosby, 2001.
2. Rosenstock T, Hurwitz JJ. Functional obstruction of the lacrimal drainage passage. *Can J Ophthalmol* 1982; 17: 249-255.

3. Montana A, Catalino P, Gualdi M. Improved radiological technique for evaluating the lacrimal pathways with special emphasis on functional disorders. *Acta Ophthalmologica* 1979; 57: 547–563.
4. Rossomondo RM, Carlton WH, Trueblood JH, Thomas RP. A new method of evaluating lacrimal drainage. *Arch Ophthalmol* 1972; 88: 523–525.
5. Werne MJ, Pitts J, Frank J, Rose GE. Comparison of dacryocystography and lacrimal scintigraphy in the diagnosis of functional nasolacrimal duct obstruction. *Br J Ophthalmol* 1999; 83: 1032–1035.
6. Vincent BZ, Martin C, Mark WO, Thomas WB. Nuclear dacryoscintigraphy: Its role in oral and maxillofacial surgery. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1995; 80: 645–649.
7. Shin CH, Woo KI, Chang HR. Evaluation of the Functional Nasolacrimal Duct Obstruction with Digital Subtraction Dacryocystography. *J Korean Ophthalmol Soc* 2003; 44: 529–533.
8. Amanat LA, Hilditch TE, Kwok CS. Lacrimal scintigraphy II. Its role in the diagnosis of epiphora. *Br J Ophthalmology* 1983; 67: 720–728.
9. Hanna IT, MacEwen CJ, Kennedy N. Lacrimal scintigraphy in the diagnosis of epiphora. *Nucl Med Commun* 1992; 13: 416–420.
10. Conway ST. Evaluation and management of ‘functional’ nasolacrimal blockage: results of survey of the American Society of Ophthalmic and Reconstructive surgery. *Ophthalm Plast Reconstruct Surg* 1994; 18: 185–187.
11. Angrist RC, Dortzbach RK. Silicone intubation for partial and total nasolacrimal duct obstruction in adults. *Ophthalm Plast Reconstruct Surg* 1985; 1: 51–54.
12. Katowitz JA, Hollstein DA. Silicone intubation of the nasolacrimal drainage system. In: *Lacrimal Surgery*, Linberg JA (eds), New York; Churchill Livingstone, 1988: 109–123.
13. Chung WS, Park NG. Functional obstruction of the lacrimal drainage system. *J Korean Ophthalmol Soc* 1995; 36: 1435–1438.
14. Heo DW, Sohn MG, Kin YD. Silicone Intubation for Functional Nasolacrimal Duct Obstruction. *J Korean Ophthalmol Soc* 2000; 41: 2303–2307.