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Diagnostic accuracy of fluorescein dye disappearance test in comparison with lacrimal syringing in evaluation of epiphora

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ABSTRACT

Background: Epiphora is the overflow of tear in the lid margin. It can be due to hyper secretion or inadequate tear drainage. Inadequate drainage of tears may be due to mechanical or physiological causes. Physiological cause is due to lacrimal pump failure or weakness of orbicularis muscle. Mechanical causes are due to obstruction in the lacrimal passages. Evaluation of epiphora can be done by lacrimal syringing, fluoresceine dye disappearance test, Jones dye test, contrast dacryocystography, nuclear lacrimal scintigraphy, CT, MRI etc. Fluoresceine dye test is a non invasive method to study tear flow drainage system. Our study evaluate the effectiveness of dye disappearance test to lacrimal syringing which is a invasive test. Aim of this study was to evaluate the accuracy of fluorescein dye disappearance test [FDDT] in evaluating epiphora in comparison to lacrimal syringing.

Materials and Methods: A prospective observational study was conducted in 90 consecutive patients of age group of 40 to 70 years who presented with epiphora in Department of ophthalmology at tertiary care centre. Any cause like foreign body, trauma, blepharitis, lid disorders like ectropion, entropion, history of lacrimal sac surgeries in the recent past, and allergy to sodium fluorescein excluded from the study.

A thorough medical history and comprehensive ophthalmological examination done in all patients. Epiphora evaluated with regurgitation over pressure on the lacrimal sac area, lacrimal syringing, and fluorseceine dye disappearance test.FDDT resulte were graded as grade 1 to 4 according to the quantity of flouorseceine stain in the conjunctival sac, Grade 1 and 2 considered as normal and grade 3 and 4 considered as abnormal.Results of FDDT, syringing, ROPLAS compared in the patients with epiphora.

Results: In the study group, the 90 samples were analysed. The sample population were 62% males and 38% females. There were co-morbidities like diabetes mellitus and cataract noticed in the population. When we examined the diabetes mellitus patients presented with epiphora, showed lacrimal passage obstruction is more common in diabetes patients [67% patients among diabetes patients have FDDT of grade 2-3]. Regurgitation on pressure over lacrimal sac] test were done in all patients presented with epiphora, and the test was positive in 21 patients. FDDT were done in these patients and the results showed only 14 patients were Grade 2-3 [67%]. We compared the FDDT and lacrimal syringing tests in epiphora patients. Among the 90 patients we found that 60 individuals had patent nasolacrimal passages, verified by free flow in Lacrimal syringing test. FDDT showed majority of the patients were under grade 0-1 [patent nasolacrimal passages]. The patients with blocked nasolacrimal passages verified by lacrimal syringing were found grade 2-3 in FDDT [Blocked nasolacrimal passages]. Sensitivity, specificity, and positive and negative predictive value of FDDT were calculated.

Conclusion: FDDT is a safe and effective test for the evaluation of epiphora. It can be done as a screening test in pre operative evaluation of cataract surgery.

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1. Introduction

Epiphora is the overflow of tears at the eye lid margin. It is described in the era of Hippocrates.[1] Tearing usually occurs due to improper function of lacrimal drainage system.[2] A compromised lacrimal drainage occurs due to obstruction of lacrimal sac pathway or lacrimal pump failure.[3] Evaluation of epiphora starts with a proper history to exclude hyper secretion and a thorough ophthalmological examination. Inspection of puncta, eye lid position, misplaced eye lashes and presence of lid laxity should be examined.[4,5]

Evaluation of epiphora can be done by lacrimal syringing, fluorseceine dye disappearance test,[6] Jones dye test, contrast dacryocystography,nuclear lacrimal scintigraphy,[7–9] CT, MRI etc. These tests help us to identify site of obstruction and lacrimal pump failure. Syringing is done routinely as a pre operative evaluation before cataract surgery. But this test is invasive and can lead to injury of lacrimal puncta and cannaliculi.[10]

FDDT test is non invasive and can be performed even in pediatric population Hence this study was done to evaluate the diagnostic accuracy of fluorescein dye disappearance test [FDDT] in comparison with lacrimal syringing. Aim of this study was to evaluate the accuracy of fluorescein dye disappearance test [FDDT] in comparison with lacrimal syringing in evaluation of epiphora.

2. Materials and Methods

2.1. Study design

Prospective observational study.

2.2. Inclusion criteria

1. Patients presented with epiphora in the outpatient department, age group of 40-70 years.
2. Patients who were willing to follow the study protocol.

2.3. Exclusion criteria

1. Any cause of lacrimation like foreign body, trauma, blepharitis, lid. disorders like ectropion, entropion.
2. History of lacrimal sac surgeries in the recent past.
3. Allergy to sodium fluorescein dye.

A thorough medical history and comprehensive ophthalmological examination done in all patients. Epiphora evaluated with regurgitation over pressure on the lacrimal sac area, lacrimal syringing, and flourascine dye disappearance test. FDDT The test involves placing a small amount of fluorescein dye in the lower conjunctival sac of the eye. The patient is then instructed to blink a few times to distribute the dye evenly over the surface of the eye. After about 5 minutes, the eye is examined under a blue light with a slit lamp microscope to assess the distribution of the dye on the cornea. The amount of time it takes for the dye to disappear can indicate the quality of the tear film and the health of the cornea. FDDT results were graded as grade 1 to 4 according to the quantity of fluorseceine stain in the conjunctvival sac, Grade 1 and 2 considered as normal and grade 3 and 4 considered as abnormal. Results of FDDT, syringing, ROPLAS compared in the patients with epiphora.

Results were recorded as Roplas-present/absent. Lacrimal syringing free (Patent), blocked (partial and complete obstruction). All result were tabulated and analysed.

3. Results

The study was conducted in 90 patients of age group of 40-70 yrs who are presented with symptoms of epiphora. ROPLAS test, lacrimal syring, an FDDT done in all patients.

Regurgitation on Pressure over the Lacrimal SAC were found in 23% the sampling population who presented with epiphora.

Lacrimal syringing –noticed free duct in 68% of patients presented with epiphora, and blocked lacrimal passages in 33% of the epiphora patients.

Fluorescein dye disappearance test [FDDT]- The result showed in the below Table 1.

Conducted FDDT in all patients who were presented with epiphora. Grade 0, and Grade 1 indicates patency of the lacrimal passages. Grade 2 and 3 indicates blocked lacrimal passages. In the study, 60 percent of the sample population having grade 0 and 1 on FDDT and 40 percent belongs to grade 2 and 3 on FDDT.

Table 1:

FDDT	Frequency	Percent
Grade 0	26	28.90
Grade 1	28	31.10
Grade 2	17	18.90
Grade 3	19	21.10
Total	90	100

Diabetes mellitus and FDDT grading shows lacrimal passage obstruction is more common in diabetes patients [67% patients among diabetes patients are having FDDT of grade 2 -3] and this result showed statistically significant in the study [p value of less than 0.001].

Test were absent in 69 patients, among this FDDT shows 68% Grade 0-1 and 32% grade2-3. In ROPLAS positive 21 patients FDDT shows 33% included in grade 0-1 and 67% included in grade 2-3. So the correlation is statistically insignificant [xp value is 0.004].

Lacrimal syringing was done in 90 patients with epiphora, and found that 30 patients have blocked lacrimal passage. Among the free lacrimal passage patients, FDDT

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Table 2: Roplas and FDDT

DM	FDDT Grade 0-1		FDDT Grade 2-3		Total		χ 2	df	p
	n	%	N	%	n	%			
Present	9	33.3	18	66.7	27	100	11.429	1	0.001
Absent	45	71.4	18	28.6	63	100			
Total	54	60	36	40	90	100			

Table 3: ROPLAS [Regurgitation on pressure over the lacrimal SAC]

ROPLAS	FDDT Grade 0-1		FDDT Grade 2-3		Total		χ 2	df	p
	N	%	N	%	n	%			
Present	7	33.3	14	66.7	21	100	8.116	1	0.004
Absent	47	68.1	22	31.9	69	100			
Total	54	60	36	40	90	100			

Table 4: FDDT and lacrimal syringing

Syringing	FDDT Grade 0-1		FDDT Grade 2-3		Total		χ2	df	P
	N	%	N	%	n	%			
Free	51	85	9	15	60	100	46.875	1	<0.001
Blocked	3	10	27	90	30	100			
Total	54	60	36	40	90	100			

found to have grade 0-1 in 85%. Among the blocked passages in lacrimal syringing 90% have FDDT of grade 2-3 obtained. The correlation is statistically significant [p value less than 0.001].

ROC curve of FDDT score to predict blocked syringing was plotted to assess the optimum cut off value of FDDT. The area under curve of the ROC was 0.923 with 95% CI of AUC was 0.848 to 0.969 shows that the FDDT score has greater accuracy to predict blocked syringing. The optimum cut off value of FDDT score to predict blocked syringing was >2 with sensitivity 90% and specificity 85%, positive predictive value 89.5% and negative predictive value 81.7%].

4. Discussion

Lacrimal syringing is done routinely to assess the lacrimal drainage pathway patency. Nasolacrimal duct block can be congenital or acquired and its frequency ranges from 10.2 to 33%. [11–13] Epiphora can be treated by improving lacrimal pump function and reducing duct resistance. [14,15] Evaluation epiphora is done routinely with lacrimal syringing. It requires patient co-operation and can lead to damage in the lacrimal cannaliculi and punctum. This test is difficult to do in paediatric population. FDDT is easier to perform, non invasive and can be done in paediatric population. So we conducted this study check feasibility of using FDDT as screening test for checking lacrimal system patency and its effectiveness compared to lacrimal syringing.

In the 90 sample of patients with epiphora we found that after doing the lacrimal syringing 30 patients have blocked the lacrimal passage system [33%], and 60 persons having [67%] having free lacrimal passage. FDDT [fluorescein dye disappearance test] grade 0, 1 were confirmed to have patent lacrimal system on lacrimal syringing. Only 3 eyes [10%] have blocked passages in lacrimal syringing with FDDT of grade 0-1, that means false negative of 10% of eye tested. Eyes with blocked lacrimal passage on syringing were 27 eyes, on FDDT, out of them 24 eyes were grade 2-3, which means 90% sensitivity of FDDT.

ROPLAS [regurgitation on pressure over lacrimal sac] was found only in 23% [21 eye] of 90 eyes with epiphora.14 eyes were found to be FDDT grade of 2-3 and 7 eye were of FDDT grade 0-1. We found that the correlation is statistically insignificant.

According to this study, 90% of epiphora patients with FDDT grade 2 or higher will have a blocked lacrimal system. There is an 85% chance of having a patent system if the FDDT grade is normal 0-1. This clearly shows the advantage of using FDDT as a screening test for lacrimal drainage patency.

We noticed, in the study population 27 patients were suffering from diabetes mellitus presented with epiphora. The FDDT showed 67% of [grade 2-3] having blocked lacrimal passages. Hence, we recommend lacrimal syringing is mandatory in diabetes patients presented with epiphora.

A cross-sectional comparative study on 58 patients with epiphora done by Kashkouli et al. showed.

Table 5: Syringing and FDDT score

FDDT Score	Syringing				Total	
	Free		Blocked			
	N	%	n	%	n	%
1	25	41.7	0	0.0	25	27.8
2	26	43.3	3	10.0	29	32.2
3	7	11.7	10	33.3	17	18.9
4	2	3.3	17	56.7	19	21.1
Total	60	100.0	30	100.0	90	100.0

Table 6: ROC curve

Area under the ROC curve (AUC)	
Area under the ROC curve (AUC)	0.923
Standard Error	0.0267
95% Confidence interval	0.848 to 0.969
Youden index J	0.75
Optimum cut off	>2
Sensitivity	90
Specificity	85

Table 7: Positive and negative predictive values

FDDT	Sensitivity	Specificity	+LR	-LR	+PV	-PV
≥1	100	0	1		33.3	
>1	100	41.67	1.71	0	46.2	100
>2	90	85	6	0.12	75	94.4
>3	56.67	96.67	17	0.45	89.5	81.7
>4	0	100		1		66.7

The sensitivity, specificity, positive predictive value, and negative predictive value for -FDDT as 82.8%, 91.4%, 90.6%, and 84.1%, respectively.[16] Anatomical location of the block cannot be identified with this test.

5. Conclusion

A straight forward, non-invasive, and extremely sensitive approach for assessing epiphora is the fluorescence dye disappearance test (FDDT). Fluorescein dye is commonly used in ophthalmic practices like applanation tonometry, and to identify ocular surface pathology. An additional advantage is that it can be used in FDDT, in the evaluation of lacrimal outflow obstruction. It is simple to obtain fluorescein, no screening tests are required, and it can be used frequently without causing the patient any difficulty. Additional benefits in infants and children presenting with epiphora as FDDT is patient friendly in this group. Lacrimal syringing is an invasive and painful procedure and patient compliance is poor, and universal precaution is mandatory before doing the procedure. There are recommendations to avoid lacrimal syringing immediately before cataract surgery. Therefore, it is advised to routinely add FDDT to tests before cataract surgery to find any lacrimal outflow restriction. FDDT can be used as a screening tool to determine lacrimal outflow blockage due to its great sensitivity.

6. Source of Funding

None.

7. Conflict of Interest

None.

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