

## Role of Radio-Nuclide Dacryoscintigraphy in Evaluation of Obstruction of Nasolacrimal Passage

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### Abstract

**Background:** We aimed to study the effectiveness of radionuclide dacryoscintigraphy in assessing the patency of naso-lacrimal passage, and locating the site of obstruction in the passage so that further treatment plan can be decided and prognosis can be improved.

**Methodology:** The study was conducted as an interventional study on patients presenting with chronic dacryocystitis at tertiary care Centre of North India. Patients were evaluated using multiple converging holes colimeter attached to a e-cam gamma camera, with technetium 99m per technetate in the dose of 50-100 microcuri, instilled near medial canthus. The captured imaged were analyzed visually with the help of nuclear medicine specialists. Patients were managed based upon diagnosis.

**Results:** Out of 32 cases of chronic dacryocystitis, Radio-Nuclide Dacryoscintigraphy was suggestive of partial and complete obstruction in 7 (21.9%) and 22 (68.8%) cases respectively. In majority i.e. 59.4% cases, the obstruction was at the level of neck of lacrimal sac. About 71.4% and 63.6% partial and complete obstruction respectively were at the level of neck of lacrimal sac. Based upon the type of obstruction, management was done. Repeated syringing at regular intervals with antibiotic solution was done in case of partial obstruction whereas dacryocystorhinostomy was done for complete obstruction.

**Conclusion:** Dacryoscintigraphy is a simple method which is safe, simple and sensitive method for assessing the patency of NLD. Radionuclide dacryoscintigraphy can be utilized for detection of subclinical, partial or total lacrimal duct obstruction in patients with chronic dacryocystitis with little or no patient discomfort.

**Keywords:** Radionuclide Dacryoscintigraphy; Dacryocystitis; Nasolacrimal Duct; DCR

### Introduction

Dacryostenosis or nasolacrimal duct obstruction (NLDO) is one of the most common disorder affecting lacrimal system. The dacryostenosis may be congenital or acquired. Congenital NLDO may be observed typically within first weeks or month after delivery in approximately 6 to 20% of the newborns [1,2]. However, acquired dacryostenosis has been documented in approximately 3% of patients visiting ENT clinic i.e. with the incidence rate of approximately 37 cases per 100,000 annually [3,4]. Acquired dacryostenosis is mainly due to

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multifactorial etiology, such as trauma, systemic disease, neoplasm, radiotherapy, or chemotherapy [5]. The normal mucosa is resistant to bacterial infection whereas diseased or unhealthy mucosa (as in the case of chronic dacryocystitis) may be a predisposing factor for infection as it is associated with stasis of Lacrimal fluid [6]. The patient with NLDO may present with excessive tearing and ocular discharge, followed by redness and signs of inflammation at the periorbital area and eye lids. Visual abnormalities and severe headache may be the associated symptoms [7].

Though the diagnosis of NLDO can be made based upon history, fluorescein dye disappearance test could be used for confirming the diagnosis [8]. Currently, X-ray dacryocystogram [DCG] is imaging modality used for assessment of patency of nasolacrimal duct. However, Xray DCG requires manual injection of contrast following intubation of the canaliculi to fill the tear duct. In presence of distortion of anatomy, the necessary intubation may be difficult and lead to various complications [9].

The assessment of functional integrity of nasolacrimal duct could also be done by visualizing the lacrimal drainage system with the help of radiopharmaceuticals placed in conjunctival sac, nasal cavity and nasolacrimal duct. This procedure is also called dacryoscintigraphy [10]. In 1972 Rassomondo, *et al.* first introduced the concept of radionuclide dacryoscintigraphy following the instillation of a drop of <sup>99m</sup>technetium rhenium colloid into the conjunctival sac. The material spreads over the globe by capillary action, thus was utilized in labeling tears and outlining the drainage pathways. Sequential images are obtained and normally drainage into the nose is seen in first few minutes. Though it has been used since 1972, this tool is often an underutilized in clinical practice [11]. The present study was therefore conducted to study the effectiveness of radionuclide dacryoscintigraphy in assessing the patency of naso-lacrimal passage, and locating the site of obstruction in the passage so that further treatment plan can be decided and prognosis can be improved.

### Methodology

The study was conducted as an interventional study on patients presenting with chronic dacryocystitis at Department of Ophthalmology, tertiary care center of North India during the study period of 18 months i.e. from 1<sup>st</sup> November 2019 to 30<sup>th</sup> April 2021. All the patients diagnosed as a case of chronic dacryocystitis belonging to age range of more than 18 years and willing to participate in the study were enrolled whereas patients belonging to less than 18 years of age, or not willing for dacryocystography were excluded. Detailed history including sociodemographic variables, mode of presentation, duration of symptoms, associated comorbid conditions etc. was obtained using questionnaire. Patients were then subjected to local and clinical examination and findings were documented.

### Dacryocystography

All the cases were evaluated using multiple converging holes colimeter attached to a e-cam gamma camera, with technetium <sup>99m</sup>per technetate in the dose of 50 - 100 microcuri, instilled near medial canthus. For this, patient were positioned (sitting upright), facing towards gamma camera with the head fixed in an adjustable stand [12,13]. About 0.1 cc isotonic saline containing technetium <sup>99m</sup>per technetate was instilled at the lateral canthus of each conjunctival sac in lower fornix of the affected eye using insulin syringe without the needle. With the help of collimeter attached to e-cam gamma camera, high resolution images were acquired for 20 minutes (at one frame per minute).

The captured imaged were analyzed visually with the help of nuclear medicine specialists. Based upon the findings of visual interpretation, obstruction was categorized as [14]

- Normal- notable drainage of activity from the lacrimal sac before the 5th minute of the study
- Partial obstruction- delayed radiotracer washout from the lacrimal sac (in the presence of some drainage of activity after the first 5 minutes of the study)

- Complete obstruction- absence of notable radiotracer washout up to the end of the study Based upon these findings, patients were managed using appropriate approach.

**Statistical analysis**

Data was compiled using Ms Excel and analyzed using IBM SPSS software version 20. Categorical variables were expressed as frequency and proportions whereas continuous variables were expressed as mean and standard deviation.

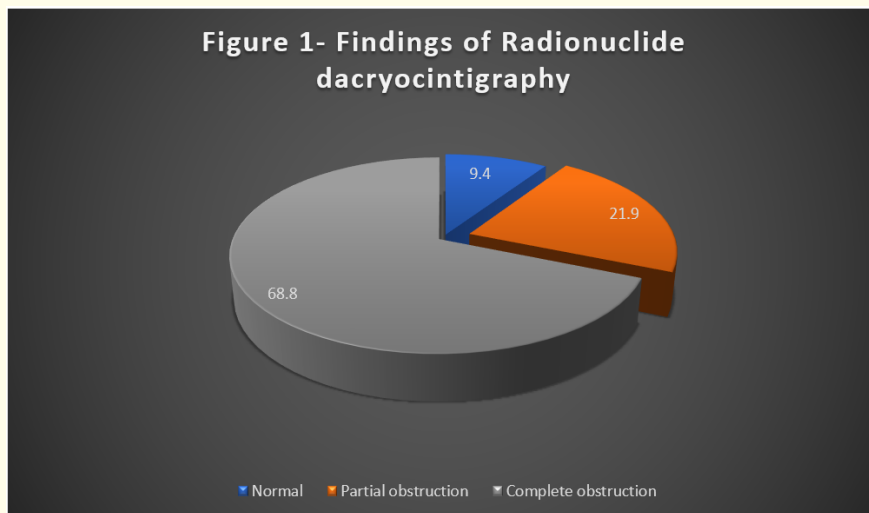
**Results**

A total of 32 cases of chronic dacryocystitis were included in our study. Mean age of study participants was 50.81 ± 14.6 years.

Sociodemographic Variables		Frequency (N = 32)	Percentage
Age (years)	≤ 30	3	9.4
	31 - 45	9	28.1
	46 - 60	11	34.4
	> 60	9	28.1
Gender	Male	20	62.5
	Female	12	37.5

**Table 1:** Distribution of patients according to sociodemographic variables.

Majority of patients belonged to 46 to 60 years of age (34.4%) whereas only 9.4% patients belonged to less than 30 years of age. Male preponderance was observed for chronic dacryocystitis in our study with male:female ratio of 1.7:1.



**Figure 1**

Out of 32 cases of chronic dacryocystitis, Radio-Nuclide Dacryoscintigraphy was suggestive of partial and complete obstruction in 7 (21.9%) and 22 (68.8%) cases respectively. However, no obstruction was noted in 3 (9.4%) cases.

Normal		Radio-Nuclide Dacryoscintigraphy			
		Partial obstruction	Complete obstruction	Total	
Level	None	3 (100%)	0 (0%)	0 (0%)	3 (9.4%)
	At the level of neck of lacrimal sac	0 (0%)	5 (71.4%)	14 (63.6%)	19 (59.4%)
	At the level of common canaliculus	0 (0%)	2 (28.6%)	8 (36.4%)	10 (31.2%)
Treatment	None	3 (100%)	0 (0%)	0 (0%)	3 (9.4%)
	Repeated syringing	0 (0%)	7 (100%)	0 (0%)	7 (21.9%)
	Dacryocystorhinostomy	0 (0%)	0 (0%)	22 (100%)	22 (68.8%)

**Table 2:** Association of Radio-Nuclide Dacryoscintigraphy with level of obstruction and management.

In majority i.e. 59.4% cases, the obstruction was at the level of neck of lacrimal sac. About 71.4% and 63.6% partial and complete obstruction respectively were at the level of neck of lacrimal sac. Based upon the type of obstruction, management was done. Repeated syringing at regular intervals with antibiotic solution was done in case of partial obstruction whereas dacryocystorhinostomy was done for complete obstruction.

### Discussion

Dacryocystitis is an inflammatory condition of nasolacrimal sac, typically caused by nasolacrimal duct obstruction [15]. Chronic Dacryocystitis usually results from duct obstruction secondary to chronic or repeated infection and accumulation of inflammatory debris. It may also be associated with systemic disease (such as Wegeners granulomatosis, SLE, and sarcoidosis) and dacryoliths [15,16]. The present study aimed to study the patency of nasolacrimal duct using radionuclide dacryoscintigraphy in patients with chronic dacryocystitis.

The patients with chronic dacryocystitis usually manifest in the third decade of life [6]. In our study, approximately 90% patients with chronic dacryocystitis belonged to more than years of age and about 62.5% cases were males. Similar findings were documented by Bale, *et al*, in which about 78% patients were over 30 years of age [6]. Wadgaonkar, *et al*. also documented higher incidence of chronic dacryocystitis in middle aged population [17]. Female predominance was documented by previous studies, which was contrasting to the findings of present study [6,17]. The observed difference in gender between present study and reference study could be attributed to difference in health seeking behavior of male and female in our study area.

In our study, Radionuclide Dacryoscintigraphy was utilized to assess the patency of nasolacrimal duct. Once the drop of <sup>99m</sup>Tc is instilled into the conjunctival sac, it spreads by capillary action all over the globe of eye. The tracer material along with the tears flow through the canaliculi, lacrimal sac and finally to nose through nasolacrimal duct. The dynamic flow of radioactive material is helpful in assessment of functional integrity of nasolacrimal duct. This method is a sensitive method for assessing the patency of nasolacrimal system. <sup>99m</sup>Tc-pertechnetate was used as a tracer for dacryoscintigraphy and it has been considered as a physiologic saline solution. The nucleo-radionuclide scintigraphy has certain advantages over contrast dacryocystography. This method is non-invasive, simple, avoid the need of general anesthesia and can be done in patients belonging to any age. One of the greatest advantage with this method is this procedure is less cumbersome to the patients and assess the tear drainage system physiologically. Also, radiation exposure with this method is also low (0.14-0.21 mGy) as compared to absorbed dose of skull X ray (30mGy) [18]. However, high cost of equipment as well as the tracer material along with availability of facility for diluting the radioactive tracer material and expert to read the images are its disadvantages [19].

As the method is highly sensitive, normal finding excludes tear flow disturbance with high probability [18]. In our study, Dacryoscintigraphy was normal in 9.4% cases whereas partial and complete obstruction was noted in 21.9% and 68.8% cases respectively. However, obstruction was at the level of neck of lacrimal in maximum cases, whereas common canaliculus either partly or completely obscured in less than half of the patients. Based upon the type of obstruction, management strategies were planned. For partial obstruction, repeated syringing at regular intervals with antibiotic solution was done whereas for complete obstruction, dacryocystorhinostomy was the procedure of choice. To best of our knowledge, none of the previous study have evaluated the role of radionuclide dacryoscintigraphy in estimation of NLDO in chronic dacryocystitis. However, previous studies have documented the superiority of this methods as compared to dacryocystography in terms of patients comfort, low radiation dose as well as no need for intubation. Also, dacryocystography may not identify block due to mucus plug or other debris and block due to anomalous valve of Krause or valve of Taillefer in the nasolacrimal duct; but radionuclide dacryoscintigraphy being a physiological method may identify even minute or temporary blocks [20-23].

The study had certain limitations, firstly only the affected side was taken into study for consideration. The study was conducted on small number of patients using purposive sampling and thus the findings could not be generalized.

### Conclusion

Dacryoscintigraphy is a simple method which is safe, simple and sensitive method for assessing the patency of NLD. Our study suggested that radionuclide dacryoscintigraphy can be utilized for detection of subclinical, partial or total lacrimal duct obstruction in patients with chronic dacryocystitis with little or no patient discomfort. This method is not only helpful in identifying the level of obstruction, but can be helpful in guiding treatment in such patients.

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