

1 **Effectiveness of non-surgical management of**  
2 **Congenital Nasolacrimal Duct Obstruction.**

3  
4 **Abstract:**

5 **Background:** Congenital nasolacrimal duct obstruction is the common disorder  
6 leading to epiphora and is usually due to the failure of canalization of nasolacrimal  
7 duct. Canalization of the nasolacrimal duct usually occurs by six months of intrauterine  
8 life. Common causes of nasolacrimal duct obstruction are absence or atresia of  
9 canaliculi and puncta, congenital atresia of duct, presence of membrane at the valve  
10 of Hasner, absence of valves, lacrimal sac mucocele, clogging, craniofacial  
11 abnormalities etc.

12 **Methods:** 100 babies (108 eyes) below 2 years of age diagnosed as congenital  
13 nasolacrimal duct obstruction were included in the study. Hydrostatic sac massage  
14 was performed weekly by the clinician and proper technique was explained to the  
15 parents for massaging at home. All babies were followed weekly for 6 months.  
16 Successful hydrostatic sac massage was documented when complete resolution of  
17 symptoms occurred.

18 **Results:** The most common sign of congenital nasolacrimal duct obstruction was  
19 mucopurulent discharge (62.96%) followed by epiphora (31.48%), mucocele (3.70%)  
20 and lacrimal abscess (1.85%). The overall effectiveness of hydrostatic sac massage in  
21 babies below 2 years of age was 80.55% and it was most effective in 6-12 months age  
22 group (88.23%). The success rate decreases with increasing age.

23 **Conclusion:** Hydrostatic sac massage of the nasolacrimal duct is a safe and viable  
24 option as a primary treatment modality for congenital nasolacrimal duct obstruction in  
25 babies below 2 years of age. Results of the study may encourage us to proceed for  
26 early non-surgical intervention of CNLDO by hydrostatic nasolacrimal sac massage  
27 rather than waiting for spontaneous resolution.

28 **Keywords:** Congenital Nasolacrimal Duct Obstruction; Epiphora; Hydrostatic sac  
29 massage.

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35  
36 **INTRODUCTION:**

37 Epiphora is abnormal overflow of tears due to excessive secretion of tears or  
38 obstruction in lacrimal drainage passage<sup>1</sup>. Congenital nasolacrimal duct obstruction  
39 (CNLDO) is the most common cause of epiphora and is usually due to failure of its  
40 distal end canalization<sup>2, 3</sup>. Canalization of the nasolacrimal duct (NLD) usually occurs  
41 at the end of six months of intrauterine life, but it may be delayed for many weeks or  
42 months even after birth<sup>2, 3</sup>. Various other factors as abnormalities within the nasal  
43 passage, complete osseous obstruction etc may also result in obstruction of the  
44 nasolacrimal duct<sup>4</sup>. CNLDO is a common disorder that affects about 20% of all  
45 newborns. It is observed that about 30% of full term infants have nasolacrimal duct  
46 obstruction at birth, out of which only 2 to 4% present with symptoms<sup>5</sup>. The majority of  
47 cases (96%) usually resolves and become asymptomatic by the age of 1 year<sup>5, 6</sup>. Few  
48 cases of nasolacrimal duct obstruction (NLDO) may present delayed due to failure of  
49 early recognition as tears are normally produced a few weeks after birth<sup>7</sup>. Various  
50 causes of CNLDO are atresia or absence of canaliculi and puncta, mucocele of  
51 lacrimal sac, atonic lacrimal sac, presence of membrane at the valve of Hasner,  
52 malformed valves, congenital atresia of NLD, cloggin, craniofacial disorders etc<sup>6, 7</sup>.  
53 Many controversies are there in view of the natural course and management of  
54 CNLDO, in general, spontaneous resolution is expected<sup>4</sup>. Crigler had described a  
55 technique of applying pressure in a specific manner over the nasolacrimal sac area  
56 followed by topical antibiotics if active infection is present<sup>8</sup>. Various studies had  
57 reported success rate of CNLDO resolution without surgery from 32% to 95% by 13  
58 months of age<sup>8, 9</sup>. It is further reported that about 90% of the infants respond to  
59 nasolacrimal duct massage in first year of life and 60% respond in their second year of  
60 life<sup>9, 10, 11</sup>. The purpose of the present study was to evaluate the effectiveness of  
61 Hydrostatic Lacrimal Sac Massage in CNLDO in various age groups below 2 years of  
62 age.

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#### 64 **MATERIAL AND METHODS:**

65 This prospective interventional study was conducted in a tertiary care rural hospital in  
66 Central India from Jan 2017 to April 2019. 100 babies (108 eyes) below 2 years of age  
67 diagnosed as CNLDO were included after taking informed written consent from the  
68 parents and approval from the institutional ethical committee. The babies were divided  
69 into 4 age strata as Group 1: infants below 6 months of age, Group 2: infants between  
70 6 to 12 months, Group 3: toddlers between 12 to 18 months of age and group 4: older  
71 toddlers between 18 to 24 months.

72 **Inclusion Criteria:**

- 73 1. Babies below 2 years of age diagnosed as CNLDO (unilateral/bilateral).
- 74 2. Babies below 2 years of age with previous diagnosis of CNLDO and failed  
75 conservative treatment.
- 76 3. Babies below 2 years of age with congenital dacryoceles that did not resolve within a  
77 few weeks.
- 78 4. Babies below 2 years of age with copious mucopurulent discharge.

79 **Exclusion Criteria:**

- 80 1. Infants with acute dacryocystitis.
- 81 2. Any secondary cause of watering eye as blepharitis, congenital glaucoma ,  
82 conjunctivitis.
- 83 3. Ocular abnormalities as punctal stenosis, agenesis, ectopic puncta, congenital  
84 ectropion.
- 85 4. Any congenital craniofacial anomalies as Goldenhar's syndrome, Crouzon's  
86 syndrome or Treacher-Collins syndrome.
- 87 5. Any nasal disorder or history of nasal or sinus surgery or exposure of radiation to  
88 the nasal area.

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90 The diagnosis of CNLDO is based on the history of watering or discharge from  
91 unilateral or bilateral eye within the first few weeks after birth. Other symptoms such  
92 as crusting, mucopurulent discharge, stickiness of lids and redness may be  
93 associated. Parents may give history of stickiness of lashes in morning or after the  
94 child takes a nap. The tear meniscus may be high in the eye with CNLDO<sup>12</sup>.

95 The diagnosis of CNLDO was confirmed by gently pressing over the nasolacrimal sac  
96 area and observing reflux of fluid from punctum<sup>13</sup>. In doubtful cases, the dye  
97 disappearance test<sup>13</sup> was done. After instilling a topical anesthetic, a drop of 2%  
98 fluorescein dye was placed in the inferior fornix and tear film was observed with cobalt  
99 blue light of slit lamp bio-microscope or direct ophthalmoscope in uncooperative  
100 babies. Delay in clearance of the dye after 5 minutes indicated outflow obstruction of  
101 lacrimal apparatus<sup>14, 15</sup>.

102 Other causes of watering eye as congenital glaucoma, lid abnormalities like ectropion,  
103 entropion and epiblepharon, lash abnormalities like trichiasis and distichiasis, corneal  
104 surface abnormalities and conjunctivitis or keratitis<sup>16</sup> were carefully ruled out. Watering  
105 eye with history of photophobia is indicative of possible congenital glaucoma or ocular

106 surface disease. Puncta were inspected to rule out stenosis. Corneal transparency  
107 was evaluated and corneal diameter was measured to rule out buphthalmos.

108 All the babies with CNLDO included in the study, received conservative non-surgical  
109 management of CNLDO as proper Hydrostatic Nasolacrimal Sac Massage weekly by  
110 a clinician. In addition, parents were instructed to perform hydrostatic nasolacrimal sac  
111 massage 4 times per day (each time 10 strokes of massage) at home along with  
112 instillation of topical antibiotic drops whenever a mucopurulent discharge was present.  
113 This conservative medical management was continued for 6 months in all the babies  
114 and discontinued only if there was complete resolution of symptom (epiphora).

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116 **Proper technique of Hydrostatic Lacrimal Sac Massage<sup>8,9</sup>:**

117 Lacrimal sac massage was first described by Crigler. After trimming nails and washing  
118 hands, upper and lower puncta were blocked with thumb and index finger of one hand  
119 then with index finger of other hand sac massage was given firmly in such a manner  
120 that fluid collected into the sac did not escape through puncta and was forced  
121 downward along the direction of NLD so that pressure created by the flow of fluid  
122 could open the blocked NLD by rupturing any obstruction due to membrane formation  
123 or clogging (**Photo 1**). Following this procedure, topical antibiotic drops were instilled.  
124 Parents were advised to bring their babies for follow up every week for 6 months.  
125 Successful hydrostatic sac massage was documented on complete resolution of  
126 watering and discharge together with no reflux from puncta on lacrimal sac pressure.



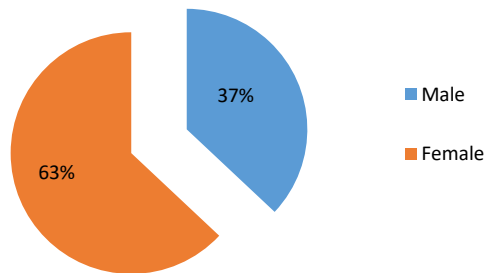
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128 **Photo 1: Technique of effective lacrimal sac massage** (Upper and lower punctum  
129 blocked and downward massage with index finger).

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131 **RESULTS:**

132 **Age-wise distribution:** A total of 100 babies (108 eyes), including 37 male babies  
 133 and 63 female babies (**Figure 1**) were included into the study. These included 38  
 134 infants below 6 months of age, 32 infants between 6-12 months, 22 toddlers between  
 135 12-18 months and 8 older toddlers between 18-24 months of age (**Table 1**).  
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137 **Figure 1: Gender-wise distribution of babies.**

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**Table 1: Age wise distribution of babies and eyes.**

Group	Age	No. of babies	No. of eyes
1	Below 6 months	38(38%)	44(40.74%)
2	6-12 months	32(32%)	34(31.48%)
3	12-18 months	22(22%)	22(20.37%)
4	18-24months	8(8%)	8(7.41%)
		100(100%)	108(100%)

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 147 **Maturity at**  
 148 **birth and mode of delivery wise distribution:** A pre-term birth is one that occurs  
 149 before the start of the 37<sup>th</sup> week of pregnancy<sup>17</sup>. Out of total 100 babies, 14 were  
 150 delivered pre-term and 86 were delivered at full term of pregnancy. Out of total 100  
 151 babies, 48 were delivered by LSCS and 52 were delivered by NVD (**Table 2**).  
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153 **Table 2: Maturity at birth and mode of delivery wise distribution.**

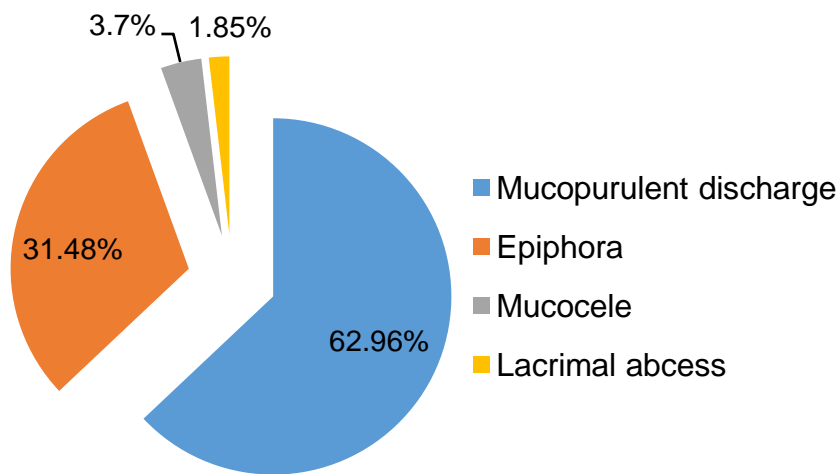
Term	Mode of delivery	No. of babies (%)	Total
Pre-term	LSCS	12	14
	NVD	02	
Full-term	LSCS	36	86
	NVD	50	
<b>Total</b>		100	100

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 160 **Onset of symptoms wise distribution:** Onset of the symptoms was before 4 weeks  
 161 of age in 18 babies and after 4 weeks of age in 82 other babies, out of 100 babies.

162 **Laterality wise distribution:** Unilateral obstruction was present in 92 babies,  
163 whereas bilateral obstruction was present in 8 other babies, to sum up total 108 eyes.

164 **Signs of CNLDO:** The most common sign was mucopurulent discharge in 62.96% (68  
165 eyes). The next common signs were epiphora in 31.48% (34 eyes), mucocele in  
166 3.70% (4 eyes) and lacrimal abscess in 1.85% (02 eyes). There was regurgitation of  
167 mucopurulent or watery fluid on pressure over the lacrimal sac in 102 babies, 4 babies  
168 had mucocele and 02 babies had lacrimal abscess with no regurgitation (**Figure 2**).

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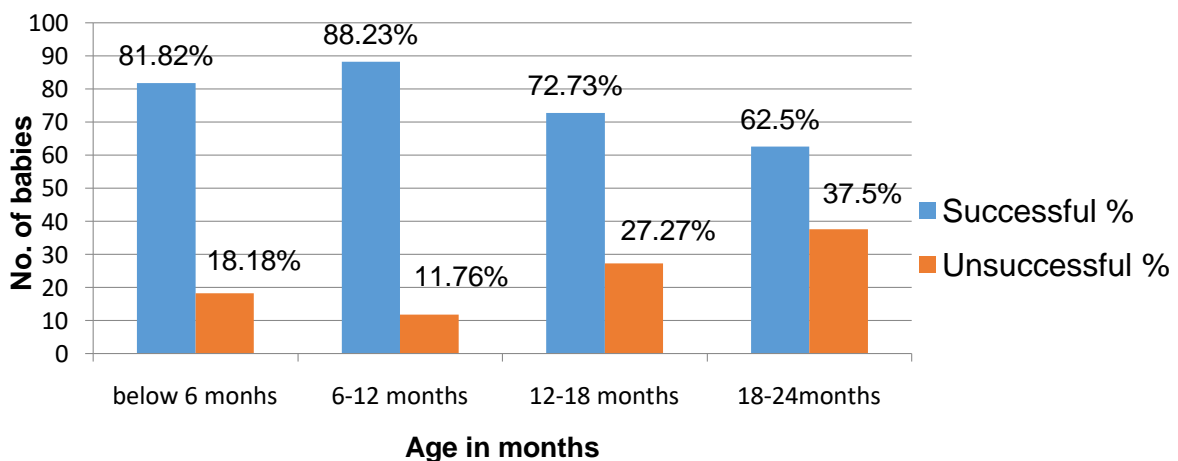


**Figure 2: Signs of CNLDO**

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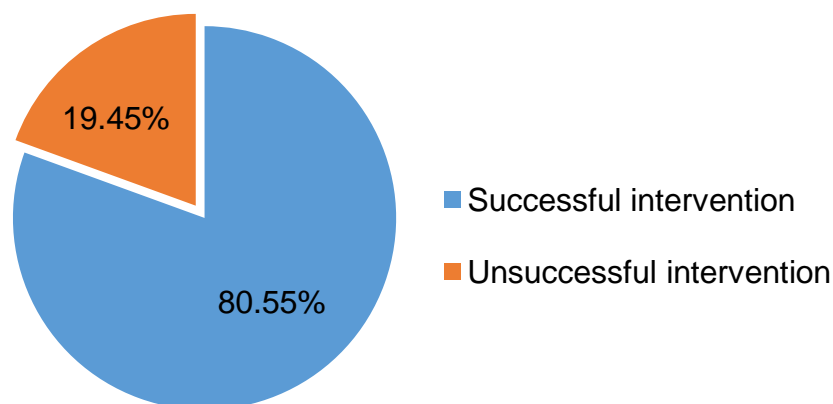
172 **Effectiveness of non-surgical management in CNLDO:** Effectiveness of non-  
173 surgical management (Hydrostatic nasolacrimal sac massage) in CNLDO among  
174 babies below 6 months of age was 81.82% (36 eyes), in 6-12 months age group it was  
175 88.23% (30 eyes), in 12-18 months age group it was 72.73% (16 eyes) and in 18-24  
176 months age group it was 62.50% (5 eyes) (**Figure 3**).



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178 **Figure 3: Effectiveness of non-surgical management in CNLDO:**

179 The overall effectiveness of hydrostatic sac massage in babies below 2 years of age  
180 was 80.55% (87 eyes) (**Figure 4**). ( $p < 0.05$ , Chi square test).  $p = 0.007$  for comparison  
181 of success rate among the age groups.



182 **Figure 4: Overall Effectiveness of non-surgical management in CNLDO:**

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#### 184 **DISCUSSION:**

185 The present study was to assess the effectiveness of non-surgical management  
186 (Hydrostatic Lacrimal Sac Massage) in infants with congenital nasolacrimal duct  
187 obstruction below 2 years of age. It was found that hydrostatic lacrimal sac massage  
188 and use of topical antibiotics was the most effective in the age group of 6-12 months.  
189 30 eyes (88.23%) were reported by parents to be asymptomatic at 6 months of this  
190 conservative management. Various studies<sup>19-23</sup> in the literature reported similar rates  
191 of NLDO resolution with non-surgical management. In a prospective study of infants  
192 upto 6 months of age, Paul<sup>16</sup> reported that 70% of eyes (26 of 37) resolved with  
193 conservative treatment by 12 months of age. Findings of the present study 88.23%  
194 (95% CI), obtained from comparatively larger sample size, is in consistent with this  
195 finding.

196 Baseline characteristics such as age, sex, laterality, age at onset of symptoms,  
197 specific signs of NLDO, history of prior treatment etc were found not associated with  
198 resolution of NLDO without surgery. About 12% eyes in which non-surgical  
199 management was not successful were re-assessed after 6 months and planned for  
200 surgical intervention after confirming the diagnosis by Dacryocystography (DCG).

201 The strengths of this study were its prospective design and a standardized period of  
202 regular follow-up. It is also possible that our rate of resolution might have been on  
203 higher side as we emphasized on Crigler hydrostatic lacrimal sac massage method<sup>8</sup>  
204 very intensively and specifically demonstrated to parents which they followed at home  
205 and on weekly basis massage was given by the clinician. But without a control group,

206 it is not possible to determine that to what extent resolution was related to the lacrimal  
207 massage, antibiotics use or simply the spontaneous resolution on passage of time.  
208 In a study conducted by Ballard including infants reported that tearing and discharge  
209 appears at 2 weeks of age in about 20% of the cases<sup>2</sup> which is in consistent with the  
210 present study, where 18% of cases had onset of symptoms before 4 weeks of birth  
211 and 82% had symptoms after 4 weeks of age. Lacrimal sac inflammation within a  
212 week of birth can cause epiphora and results reflex tearing mimicking CNLDO. This  
213 may be reason of 188 out of 443 cases (42.43%) developing symptoms during one  
214 week after birth in the study conducted by Ffookes<sup>24</sup>.

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#### 216 **CONCLUSION:**

217 Knowing that about 88% the CNLDO cases in infants below 2 years of age will resolve  
218 within 6 months with non-surgical management is an important component in decision  
219 making for clinicians to plan early or deferred surgical management and help parents  
220 more effectively to discuss treatment options. Our results may encourage one to  
221 proceed for early non-surgical intervention of CNLDO by intensive hydrostatic sac  
222 massage rather than waiting for spontaneous resolution. Hydrostatic sac massage  
223 may be considered as a standard therapy for the management of CNLDO. However,  
224 effectiveness of Hydrostatic sac massage depends on its proper technique, frequency  
225 and early intervention after onset of CNLDO.

226 **Scope of further study:** Nasal endoscopy is recommended in all the cases of  
227 CNLDO for better visualization of the blockage in the form of stenosis, atresia, inferior  
228 turbinate position, direct observation of fluorescein dye outflow and localization of site  
229 of obstruction. Based on findings of nasal endoscopy, conservative or surgical  
230 management should be planned. Further study including a control group may again  
231 refine the results.

232 **Recommendation:** Therapeutic hydrostatic nasolacrimal sac massage should be  
233 utilized for all the infants who suffer from NLDO. Further, a training program regarding  
234 therapeutic hydrostatic nasolacrimal sac massage should be designed for the  
235 clinicians, pediatric nurses and infant's caregivers.

236 **Conflicts of Interest:** None.

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