REVIEW OF LITERATURE
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Ewing (1909) was the first to advocate the use of radio-opaque material to outline a pathological naso-lacrimal passages.

In 1920, Vonszilly described the pathology of tear passages as visualized roentgenographically.

Campbell, Carter & Doub (1922) described the appearance of normal dacryocystogram. They noted the difference between the relatively narrow canal in white patients and wide in Negroes. They also stressed the need of X-ray in this regard.

Sønderman's (1923) examination of Cadavers detected that marked constriction occurred in lacrimal duct in 40% and moderate constriction in 20% while only 31% had normal lumen.

Narrowing of the osseous canal has been found in cases of dacryocystitis and tends to occur in flat nose
the bony lacrimal canal. Heinomen (1920) assumed this with a high nasal index, although this explanation is not universally accepted. Thereafter Larson and Jorgenson (1927) described the appearance of normal lacrimal passage. In 1929 Daily, L. and Daily, R.K. described the utility of dacryocystography in diseases of lacrimal apparatus.

Hourn (1937), Spackman (1938) presented the study of 100 patients and illustrated view of the normal as well as pathological outline of the naso-lacrimal passage was presented. Fox (1947) presented his experiences on dacryocystography done in cases of dacryocystitis and stressed the importance of dacryocystography. Thompson and Elestron (1948-49) published their observations on dacryocystography of normal as well as pathological lacrimal passages.

Blankstein (1952) used iodized oil in children and demonstrated dilated and atonic sacs in two and a sac of normal size and shape in third. In all the cases, the obstruction was at the upper end of the duct. The dilatation of the sac was directed forwards and was greater below the internal canthal ligament. Miedler and Demorest (1954) published their observations in dacryocystography of normal and in 1955 of pathological lacrimal passages.

Philips and George (1956) studied the size of the inlet of the canal in 10 normal and 17 epiphoric eyes and
found no significant difference in the size of the inlet. Kesavochar (1968) conducted a similar study on 21 normal and 24 epiphoric eyes and concluded that a narrower inlet of naso-lacrimal canal leads to obstruction.

Agarwal (1961) in his radiographic studies found that the most common site of obstruction to be present at the junction of the lacrimal sac and naso-lacrimal duct. Campbell (1964) stressed the importance of macro dacryocystography. His study in 200 cases analysed the obstruction in 22% at high level, in 63% at middle level and in 15% of lower level. The commonest level of complete obstruction was shown to be in the region of the neck of the sac and not as generally accepted at the bony rim of the lacrimal canal or canal itself.

Nahata (1964) studied 35 cases of chronic dacryocystitis and observed that the site of obstruction in all cases was at the sac duct junction, the obstruction being complete in 28 cases and partial in 7 cases, in 24 cases he found that the sac was enormously enlarged, dilated and atonic with the antero-posterior diameter equal to vertical. The sac was found to be small and stenosed in 3 cases and of normal size in 2 cases. In 5 cases sac was divided into a small round or tubal lobes.

Firdausi and Shukla (1964) are of the opinion that there is a little evidence to suggest that the area
of the inlet of the naso-lacrimal duct itself has got any significant role in causing an obstruction in the duct. In their radiographic studies of 50 cases, they found very little difference in the average area of the inlet in normal and diseased sac.

Saha, Bhardwaj, Malik and Jain (1967) tabulated the various diameters of normal lacrimal sac and duct. They noticed the average length of sac and naso-lacrimal duct as 11.0 mm and 20.7 x 2.2 mm respectively. According to them the incidence of lacrimal passage pathology was more in females. They also found that the commonest site of obstruction was that of sac and naso-lacrimal duct and the next site was sinus of maier. Most of the cases showed complete obstruction at the junction, of lacrimal sac and duct and more than half of the cases in this group showed mucocele formation of sac. The incidence of incomplete obstruction was found to be low.

Saha, Malik, Bhardwaj, Gupta and Chaterjee (1969) conducted the dacryocystography in 37 normal subjects and 169 patients complaining of epiphora. Concentrated dionosil aquous was found to give satisfactory results as a radio-opaque contrast media. They observed the average length of sac and naso-lacrimal duct as follows:
<table>
<thead>
<tr>
<th>Dimension</th>
<th>Lacrimal sac (mm)</th>
<th>Naso-lacrimal duct (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Vertical diameter</td>
<td>11.10</td>
<td>20.97</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Lateral diameter</td>
<td>2.43</td>
<td>2.30</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Antero-posterior diameter</td>
<td>4.00</td>
<td>2.84</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The commonest site of obstruction was the junction of the lacrimal sac and the naso-lacrimal duct (53.2%) and the next commonest site was the sinus of maier (24.3%).

In their study of lacrimal sac in pathological conditions, 11.1% of cases were having nearly normal dimensions, 11.1% had small irregular sacs, and 77.8% cases showed dilatations (54.4% in all dimensions including the vertical, and 23.4% in the lateral and antero-posterior diameters only with reduction in the vertical diameter). Females were affected more commonly than males. The incidences of age among females and males were maximum in fourth decade and late twenties respectively.

Bansal, Jain and Om Prakash in 1970 again worked on both normal and epiphoric cases. In one case, they showed congenital narrowing of upper portion of right lacrimal duct. In cases of epiphora, according to them most common site of obstruction is sac-duct junction, not a single case showed obstruction at the lower end of the duct.

Awasthi P. et al (1971) published a paper on
According to them incidence of dacryocystitis is higher in brachy-cephalic skulls, as naso-lacrimal duct is longer and narrower in these cases. In their series of 63 cases, 42 (66.6%) were of brachy-cephalic skull.

J.J. Hurwitz and R.A.N. Welham (1975) have studied one hundred lacrimal system in 51 patients, they classed 16 of these as normal. The other considered of 18 common canalicular occlusions, 14 common canalicular stenosis, 6 incomplete sac obstructions, 18 complete sac obstructions, 4 naso-lacrimal duct obstructions, 14 had upper 'Junctional blocks' and 10 had lower 'Junctional blocks'. The complete occlusions within the lacrimal drainage apparatus are diagnosed by clinical methods such as probing or syringing or more satisfactorily dacryocystography.

Malhotra A.S. and Sabharwal K.K. (1984) included 20 cases (12 males and 8 females) in the series of normal cases. The average emptying time was found less than 15 minutes (range 12 - 15 minutes).

They found the average range of length of sac lying between 10 - 15 mm, the length of the naso-lacrimal duct found ranging between 16 - 20 mm and breadth from 4.2 - 4.4 mm.

Out of total 76 cases of epiphora, the ratio of females and males was 47 : 29 (62% females) and age group ranged from 11 yrs. to 51 yrs.
In their study left eye was found most affected than right eye and the commonest site was found at the junction of sac and duct as well as at the sinus of Maier.

The contrast media used was diagonal viscas.

Contrast Medium:

Various contrast media have been used in past to visualise the lacrimal passage, such as bismuth, thorium or barium. Ewing (1909) suggested the use of bismuth subnitrate in liquid petroleum, Siccard and Forestier (1921) used a 40% solution of lipiodol diluted with olive oil. Campbell Carter and Doub (1922) utilized a suspension of bismuth in oil and took two days follow-up films to reveal any retained dye. Bollack, Siccard and Forestier (1924) introduce lipiodol as 40% iodised poppy seed oil as the medium. This was also used by Burnetti (1930), Kopylos (1930), Tooth (1932) and Höhn (1937). Lipiodol with olive oil was used by Spackman (1938), iodised oil by Fox (1947), Fox presented iodised oil studies of chronically distended sac.

Thereafter Thompson and Elston (1949) recommended the injection of a warmed iodised oil and employed the prone position for X-ray exposure.

Faillord (1951) used 30% diodone solution. Blankstein (1952) used iodised oil. Ethyl iodophenyl
undecylate (Pantopaque) was used by Milder and Demorest (1954). Normal pathological features of lacrimal tract were described.

Honnely (1956) used 5 cc. of Codopin. Agrawal (1961) used neohydriol as a contrast medium. Campbell (1964), Nahata (1964) used the same neohydriol as a contrast medium. According to them slow absorption is characteristic of the contrast medium and it remains in the tissue for a long time.

Saha, Bharadwaj, Malik and Jain (1967) used dionosil aqueous alongwith dionosil powder as a contrast medium. According to them it was found to be most suitable contrast medium for dacryocystography. With other contrast media emptying of lacrimal passages was found to be comparatively less. In 1970, Dr. Bansal, Jain and Om Prakash used dionosile aqueous as a contrast medium for dacryocystography. The emptying time was found to be dependent upon the physical property of contrast medium used. Maximum emptying time in case of dionosil aqueous was 15 minutes. While in cases of dionosil viacous it was 35 minutes.

J.J. Hurwitz and R.A.N. Welham (1975) used the contrast medium in the form of an iodized oil. The most suitable is a non-viscous fluid called 'Ultra fluid Lipiodol (May & Baker), with a viscosity of 25 centinpises at 37°C.
We used conray 280 & Conray 480 fluid as contrast medium in our cases. It is advisable to use Conray 280 or conray 420 fluid because it is homogenous, non-irritant, eventually absorbed if not discharged, non-toxic but they produce slight a bitter taste.

Radiography:

Various techniques of radiography were used in past to visualize the lacrimal passages although first of all Ewing (1909) published a paper on dacryocystography but Campbell, Caster and Doub (1922) stressed the need for X-ray to determine the exact position of obstruction in the lacrimal system. They thought, it was helpful to the Surgeons in selecting the proper type of treatment. Daily L. and Daily R.K. (1929) took postero-anterior and lateral views. They have used cocaine as an anaesthetic agent.

Spackman E.W. (1938) did not used any anaesthetic agent for the anaesthesia of conjunctiva. According to him it is unnecessary as patient did not experience any distress. X-ray films were exposed immediately after injection and at intervals of about 5 and 10 minutes. X-ray projection were made in P.A. & lateral views. On first study (immediate), only the sac is visualized, the upper part of the duct may be seen on the first examination or at the 2nd study (i.e. 5 minutes film).
Lower portion of tract is best visualized on 2nd or 3rd study (15 minutes). Fox S.A. (1947) in place of P.A. he took X-ray in A.P. and lateral views within half hour injection.

Milder B. and Demorest B.H. (1954) used pentocaine 5% as anaesthetic agent followed by Cocaine 4% soaked cotton applicator placed between the closed lids at the puncta P.A. and lateral views were taken for one eye. The same routine was followed on the other eye except that on oblique film was taken, rather than lateral and then P.A. exposure of both eyes at 30 minutes as a follow-up films. Skiagrams were taken in sitting position as it shortened the procedure and did not interfere with the normal influence of gravity on drainage of lacrimal tract.

Nahata (1964) also used 1% anaesthaine as an anaesthetic agent before injecting the contrast medium. He had also taken X-ray in antero-posterior and lateral views immediately after injection and again 30 minutes later.

Saha, Bhardwaj, Malik and Jain (1967) took skiagrams in prone position, nose chin position at an orbito-meatal angle of approximately 40° with the horizontal and then lateral view. Skiagrams were taken by using potter bucky diaphragm. They have taken two more skiagrams in similar position by increasing the object film distance keeping the
cassette 30 cms. below the table top to have magnified image of lacrimal passages. To know the emptying time they repeated the skiagrams after 15 and 30 minutes. Exposure factors they have used were 65 - 70 K.V.P. and 120 M.A.S. for P.A. projection and 50 K.V.P. and 50 M.A.S. for lateral, film taken at 100 cms. focus film distance in potter-bucky diaphragm. In magnified projection the skiagrams were taken without bucky at 125 cms. focus film distance and 30 cms. object film distance with slightly more penetration. The focal point of the X-ray machine was of 1 mm. diameter with 3 phase generator.

Bansal, Jain and Om Prakash (1970) took skiagrams similarly in P.A. and lateral view. They used 4% xylocaine as anaesthesia, P.A. view was taken in nose-chin position as an orbito-meatal angle of approximately 40° with the horizontal. In this position the lacrimal duct was parallel to the table top and so there was no distortion of the radiographic image. Lateral view of only one eye was injected and when both eyes were injected then an oblique view was taken. P.A. view was repeated after every 5 minutes till the lacrimal passages emptied. Exposure factors were 65 K.V.P. and 150 M.A.S. for P.A. view and 50 K.V.P. and 50 M.A.S. for lateral view. All skiagrams were taken at 100 cms. focus film distance with potter-bucky diaphragm. In cases of obstruction both skiagrams were repeated after 35 minutes.
J.J. Hurwitz and R.A.N. Welham (1975) did not use any anaesthetic agent for the anaesthesia of conjunctiva. They took an upright postero-anterior control film in the waters position. They found that films taken at 3, 5 and 30 minutes after instilling the contrast (lipoidal) gave the most useful information. They also performed macro-dacryocystograms.

We used 4% xylocaine for the anaesthesia of conjunctiva and took skiagrams in postero-anterior, lateral and oblique positions.

**P.A. view:**

P.A. view was taken in nose-chin position at an orbito-mental angle of approximately 40° with the horizontal. In this position, lacrimal duct was parallel to the table top and so there was no distortion of the radiographic image. Lateral view of only one eye was taken at a time. P.A. view was repeated after every 5 minutes till the lacrimal passage emptied. In cases of obstruction P.A. and lateral views were repeated after 30 minutes. Exposure factors were 60 - 70 K.V.P. and 100 M.A.S. for P.A. view skiagrams were taken at 100 cms. focus film distance with potter bucky diaphragm.
Complications:

Very few complications were reported in past. Milder and Demorest B.H. (1954) reported few complications, they reported in one patient canaliculus was damaged during the introduction of lacrimal cannula and dye extravasated into the lower lid.

No complication occurred in our study.