DISCUSSION
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The practical application of dacryocystography is of recent interest in surgery of the lacrimal passages, where it is important for a surgeon to know beforehand (1) the effect of inflammation on the lacrimal sac, (2) exact site of obstruction into the naso-lacrimal tract, and (3) the type of block, functional or absolute.

Ewing in America was the first to advocate the use of radio-opaque material to outline a pathological naso-lacrimal system.

In 1920 Von Szilly described the pathology of a tear passages as visualized roentgenographically.

Several investigators employed various contrast agents such as bismuth, thorium or barium to visualize the system.

Sicard and Forestier introduced lipoidal, iodized poppy seed oil, as a radio-opaque material.

One of the chief problems discussed by workers in this field has been the selection of ideal radio-opaque contrast media.

Oily media have the disadvantage of globule formation and may produce artefacts, and aqueous material
is usually too thin but it can be retained till the radiological procedure is completed.

We used in our study, a water soluble contrast media (conray 280 and conray 420) which were proved to be good in radio-opaque density, non-toxic, non-irritant but little bit bitter in taste.

We have studied 10 normal and 45 pathological dacryocystogram in order to evaluate the effects of disease process on naso-lacrimal passages in comparison with the normal dacryocystogram.

The healthy functional lacrimal passages are usually resistant to infective micro-organism. This happens due to resistance of mucosa itself and partly due to bacteriostatic influence of tears.

In majority of cases infection starts from the lacrimal system itself, in other cases it arises secondarily from the spread of local conditions such as gross infection of nose and sinuses, conjunctivitis and trachoma, from trauma and pericystic inflammation and also from specific infections like tuberculosis, leprosy, syphilis etc.

The infection may descend down from punctum or may ascend via the naso-lacrimal duct from nose.

Inspite of the fact that infection plays an important role in causation of dacryocystitis. The
structural variation of the lacrimal passage is equally important in the disease process.

We have interpreted these anatomical and other abnormalities, in terms of age, sex and other inflammatory features.

Age -

In our study, we found 11 cases in age group of 11-20 yrs, 16 cases in age group of 21-30 yrs, 9 cases in age-group of 31-40 yrs, 3 cases in age group of 41-50 yrs, and 1 case in 51-60 yrs. The maximum cases were in age-group of 21-30 yrs. The peak incidence for females occurred in late twenties and early thirties while in males it was in early twenties. This difference was due to the fact that specific infections are more common in males while females may suffer from chronic irritation such as that caused by smoke etc.

According to Duke-Elder (1961) highest incidence of dacrtyocystitis was in fifth decade. Besides dacrtyocystitis in the newborn, the disease affects preferentially adults over middle life and can occur in advanced stage. S.R.K. Malik et al (1969) found that the average age in females was 35.9 yrs and in males it was 23.8 yrs. The highest incidence in females was in fourth decade whereas in males it was in late twenties.
**Sex-incidence:**

Duke-Elder's (1961) ratio of male and female was 1 : 3. However, in our study, the male and female ratio comes 1 : 1.66 (Male patients were 15 (37.5%) and female patients were 25 (62.5%).

According to Duke-Elder (1961), disease in the newborn affects both sexes equally, its occurrence among adults is in the ratio of 75 to 80% females and 20 to 25% males.

It is usually said, this very striking predilection for the female is due to a narrower lumen of the bony lacrimal canal (Meller, 1929; Ruiz Barranco and Martinez Roman, 1966 and others).

Saha et al (1967) also found that the incidence of lacrimal passage pathology was more in females. Malhotra et al (1984) also observed that females were more affected than males.

**Social incidence -**

In our present study, most of the patients were belonging to the poor and lower middle class families and living under unhygienic conditions. This may contribute to the occurrence of disease.
Involvement of eyes -

In our study, 35 cases (87.5%) had unilateral involvement, whereas 5 cases (12.5%) had bilateral involvement of the eyes. The left eye was more frequently involved 20 cases (50%) than the right eye, 15 cases (37.5%). Malik et al (1969) also reported that the left side was more commonly involved than right. We could not explain this kind of behaviour on the basis of radiological findings.

Presenting symptoms -

The symptoms of inflammation of lacrimal sac and duct presented many variations as found in our study.

We found mucopurulent discharge in 20 cases (50%) and watering in 14 cases (35.0%). Others being less frequent were swelling over sac area in 2 cases (5.0%) and fistula in sac area in 2 cases (5.0%).

Study of normal dacryocystogram -

In all the normal dacryocystograms the lower canaliculus lacrimal sac and naso-lacrimal duct were outlined.

The dacryocystograms of our 10 normal cases revealed that in 6 cases (60%) lacrimal sac was found to have smooth outline with a slight constriction at sac duct junction indicating the location of valve of krause.
In rest of the cases either we could not see the lacrimal sac because of rapid flow of eye or there were slight irregularity in its shape.

The canaliculi opened into a common ampulla, the sinus of maier in 98.8% and separately into the sac in the remainder.

These observations are very similar to those of Malik et al (1969). They visualized the normal lacrimal passages and observed that the canaliculi open into a common ampulla (sinus of maier) in 94.6% of cases.

Milder and Demorest (1954) presented a study based upon 30 normal patients in whom ethyl iodophenyl-undecylate (Pantopaque) was used as a contrast media. Normal features of the lacrimal tract were described and a standard technique for radiography was proposed.

Normal dacryocystogram were not studied only in order to know the configuration of lacrimal passages but also because it served as an useful comparative data for the evaluation of pathological dacryocystograms.

In our study of normal cases, the dimensions of the sac were 11.0 mm (mean) in vertical diameter, 2.5 mm (mean) as lateral diameter and 3.5 mm (mean) as antero-posterior diameter.
The dimensions of naso-lacrimal duct were 20.0 mm (mean) in vertical diameter, 2.0 mm (mean) as lateral diameter and 2.2 mm (mean) as antero-posterior diameter.

The above found values of sac and naso-lacrimal duct in normal subjects are in close relation to those mentioned in the text book of Anatomy (Duke-Elder, 1961). The observations regarding the nature of sac is also almost similar to the study of Malik et al (1969). Saha et al (1967) also tabulated the various diameters of normal sac and duct. They noticed the average length of sac and naso-lacrimal duct as 11.0 mm and 20.7 x 2.0 mm respectively.

Malhotra et al (1984) found that the average length of sac lying between 10-15 mm, the length of naso-lacrimal duct found ranging between 16-20 mm and breadth from 4.2 - 4.4 mm.

Study of Pathological dacryocystogram -

Type of inflammation:

A study of 30 patients suffering from chronic dacryocystitis was conducted by Agarwal, M.D. in 1961. He classified the type of inflammation on the basis of nature of lacrimal sac and duct in the following manner.

1. Catarrhal inflammation of short duration - There was approximately normal sized sac with obstruction at sac duct junction.
2. Catarrhal inflammation of long duration - A small shrunken sac was suggestive of long standing catarrhal infection.

3. Chronic inflammation of sac - The sac was dilated to varying degrees depending upon the duration and virulence of infection. The sac was dilated more anteriorly.

4. Chronic inflammation with acute exacerbation - There was a dilated sac with irregular shape and patches at places resulting from the adhesion to surrounding tissue.

In the study of Agarwal, M.L. (1961) the maximum case were of chronic dacryocystitis with acute exacerbation (50%) followed by the cases of simple chronic dacryocystitis (30%). In our study, we found 17 cases (37.78%) of simple chronic inflammation, 12 cases (26.67%) of chronic inflammation with acute exacerbation, 2 cases (4.44%) of chronic inflammation with acute exacerbation with fistula, 1 case (2.22%) of chronic inflammation with acute exacerbation with diverticulum, 3 cases (6.67%) of catarrhal inflammation of short duration and 3 cases (6.67%) of inflammation of long duration. Sac was absent in dacryocystogram of 7 cases (15.54%) due to upper level obstruction.
Type and site of obstruction -

Nasal duct is an osseous canal which allows no distension and being narrow it is usually the site of obstruction.

According to Wolff (1954), the sac itself slopes gently outward, while the duct inclines inward. Thus, at the point of junction there is a slight angulation as well as constriction which may lead to the obstruction.

Schaeffer (1920) stated that the lumen of the naso-lacrimal duct is frequently irregular and tortuous, predisposing to stasis and subsequent stricture.

Campbell (1964) found that the commonest site of obstruction was in the region of sac-duct junction and not at the bony rim of lacrimal canal.

Nahata (1964) also found that the commonest site of obstruction being the sac and duct junction. He preferred to divide the obstruction into complete and incomplete.

Most accepted classification was done by Saha, Bhardwaj, Malik and Jain in 1967 about the site and nature of obstruction. They classified their radiological findings into complete and incomplete obstruction.

We have also based our study upon the same criteria. In our study of 45 pathological dacryocystograms, 42 cases (93.33%) showed complete obstruction, 1 (2.22%) case had
incomplete obstruction, while 2 cases (4.44%) showed functional block.

Our results of the above study were found closely associated with those of Malik et al (1969). They found complete obstruction in 135 cases (80%) and incomplete in 15 cases (8.8%).

Nahata studied 35 cases of chronic dacryocystitis and observed that the block was complete in 28 cases and partial in 7 cases.

The most common site of obstruction in our series was found to be at the sac-duct junction in 34 (75.56%) cases, other site of complete obstruction were at lower canaliculus in 1 (2.22%) cases, at sinus of maier in 6 cases (13.33%) and at naso-lacrimal duct in 1 case (2.22%).

Saha, Bhardwaj, Malik and Jain (1967) also observed that the commonest site of obstruction was at sac and naso-lacrimal duct junction and the next site was sinus of maier.

Bansal et al (1970) also found that the commonest site of obstruction was at sac duct junction.

We observed an obstruction at the level of the sinus of maier in 13.33% cases, but Nahata (1964) and Castren and Kohonen (1964) found this in only 5.7 and 15% respectively.
Nature of sac -

In our study of abnormal dacryocystograms various dimension of the sac were taken into account.

Dialatations of the sac were considered to explain various pathological conditions as was earlier described by Agarwal, M.L. in 1961. He presented his group study of cases selected as below:

Group A - Epiphora with non-patent lacrimal system.

Dacryocystography revealed approximately normal sized sac, with obstruction at the sac-duct junction in a case who had had epiphora for short duration (about one and one-half months).

In another study, a small shrunken sac was suggestive of long standing catarrhal inflammation.

Group B - Simple chronic dacryocystitis.

The dialatation of sac was found laterally as well as antero-posteriorly the dialation was greater in the lower part. Sac presented a smooth regular outline. The site of obstruction was at the sac-duct junction.

Group C - Chronic dacryocystitis with acute exacerbation.

The dialatation of sac was laterally as well as antero-posteriorly but greater in the upper part in contrast to group B. The site of obstruction was usually at the sac
duct junction. The sac presented an irregularity in its outline.

In our study, we found that sac was present in 38 cases out of 45 total pathological dacryocystograms. We observed that in 3 cases (7.9%) dimensions were nearly normal, 3 cases (7.9%) had small irregular sac and 32 (84.21%) showed dilatation (7 (44.73%) in all dimensions including the vertical and 15 (39.47%) in the lateral and antero-posterior diameters only with reduction in the vertical diameter). The sac was absent in 7 cases due to upper level obstruction.

The observations regarding the nature of sac was found according to the study of Malik et al (1969). They showed the dilatation of sac in 77.8%. While in our present study, the dilatation of sac was found in 84.21%.

Nahata (1964) studied 35 cases of chronic dacryocystitis and found that the dilatation of sac was in 24 cases in antero-posterior diameters as well as in vertical diameters. 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.

Associated Nasal Diseases -

Schirrmn (1877) and Kuhnt (1897) suggested that nasal diseases are the source of infection in naso-lacrimal passage which usually starts from lower part of naso-lacrimal duct.
Koflar (1919), Stenger (1920), Bockstein, (1926) suggested that deviated nasal septum may compress the inferior turbinate against the lacrimal wall of nose.

Similarly, the congestive and hypertrophied conditions of mucosa may result into the destruction at the lower end of canal.

Peter (1905), Cardero (1954) and Cartin (1942) claimed that sinusitis got its coincidence with dacryocystitis into a large proportion of cases.

Trachoma virus and the virus of keratoconjunctivitis are the mode of direct spread from conjunctival infection (Sanyal and Maitra, 1942).

Destructive specific inflammations of nose like tuberculosis, leprosy, syphilis may also produce deformities resulting in lacrimal obstruction which is followed by a non-specific dacryocystitis.

In our study, we found the incidence of associated diseases as Trachoma 85%, conjunctivitis 70%, hypertrophical nasal mucosa 82%, deviated nasal septum 20% and maxillary sinusitis 35%.

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