Dacryocystography of normal and pathological lacrimal passages

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Dacryocystography is a method of visualizing the lacrimal passages by the use of radio-opaque contrast media. Ewing (1909) suggested the use of bismuth subnitrate in liquid petroleum as the contrast medium. Von Szily (1920) described the pathology of the lacrimal passages as seen by roentgenography. Lipiodol was used as the contrast medium by Bollack (1924), lipiodol with olive oil by Spackman (1938), iodized oil by Fox (1947) and Blankstein (1952), ethyl iodophenyl undecylate (Pantopaque) by Milder and Demorest (1954) and Demorest and Milder (1955), and neohydriol by Agarwal (1961) and Nahata (1964).

Material

The present study was carried out on two groups of individuals:

I. 37 control subjects These were out-patients with no complaint of epiphora. The lacrimal passages were found to be patent on syringing.

II. 169 patients complaining of epiphora The condition of the lacrimal passages was assessed by syringing and the results were correlated with those obtained by dacryocystography.

Technique

0.5 to 1 ml. concentrated dionosil solution (Saha, Bhardwaj, Malik, and Jain, 1967) was injected into the lacrimal sac through the lower punctum with a 2 ml. syringe and cannula. Skiagrams were taken immediately after the injection in the following positions:

- (a) *Postero-anterior view* The patient lay prone in the nose-chin position with the orbit at an angle of 40° to the horizontal. The central ray was directed through the infraorbital margin of the injected side, about half an inch lateral to the midline.
- (b) *Lateral view* The patient's head was turned to the injected side; the central ray was directed at the lower punctum in the postero-anterior view.

In each case a Potter-Bucky diaphragm was used.

Observations

(I) APPEARANCE OF NORMAL DACRYOCYSTOGRAM

In all the normal subjects the lower canaliculus, lacrimal sac, and nasolacrimal duct were outlined. The following observations were made:

- (a) *Canaliculi* The lower punctum and the lower canaliculi were visible in all cases

The canaliculi opened into a common ampulla, the sinus of Maier, in 94.6 per cent. of cases, and separately into the sac in the remainder.

(b) *Lacrimal sac* This was found to have a smooth outline. A shallow constriction was seen at the junction of the sac and the duct and indicated the location of the valve of Krause.

(c) *Nasolacrimal duct* In 10.8 per cent. of cases, constrictions in the column of contrast medium in the nasolacrimal duct were seen. These were possibly due to mucosal folds. In the other cases the valves were absent and the duct looked like a smooth tube. In two cases small single diverticula were seen in the lateral wall of the duct. In one case the duct was tortuous.

(d) *Measurements of lacrimal sac and nasolacrimal duct* The dimensions are summarized in Table I.

Table I *Measurements of normal lacrimal passages in 37 cases*

<i>Dimension</i>	<i>Lacrimal sac (mm.)</i>	<i>Nasolacrimal duct (mm.)</i>
(1) Vertical diameter		
Mean	11.10	20.97
S.D.	± 1.97	± 3.37
S.E.	± 0.33	± 0.56
(2) Lateral diameter		
Mean	2.43	2.30
S.D.	± 0.95	± 0.83
S.E.	± 0.16	± 0.14
(3) Antero-posterior diameter		
Mean	4.00	2.84
S.D.	± 1.49	± 0.79
S.E.	± 0.20	± 0.13

(2) CASES WITH PATHOLOGY OF LACRIMAL PASSAGES

(a) *Clinical particulars*

Sex Females were affected more commonly than males (Table II).

Table II *Sex incidence of lacrimal passage pathology*

<i>Sex</i>	<i>Number of cases</i>	<i>Percentage</i>
Male	31	18.3
Female	138	81.7

Age The average age in females was 35.9 years (range 12–80). The incidence rose steadily to a maximum in the fourth decade. This was followed by a gradual decline.

The average age in males was 23.8 (range 11–72). The highest incidence occurred in the late twenties.

The age incidence in the two sexes is shown in Fig 1 (overleaf).

FIG. 1 Age incidence of pathological findings, by sex

Side involved The left side (99; 58.8 per cent.) was more commonly involved than the right (70; 41.2 per cent.).

(b) *Radiological appearances* (Figs 2 to 6)

FIG. 2 Normal dacryocystogram for comparison with

FIG. 3 Block at level of sinus of Maier

Obstruction This was complete in 135 cases (80 per cent.) and incomplete in fifteen (8.8 per cent.). In nineteen cases (11.2 per cent.) there was no obstruction. These observations agree with those of Nahata (1964).

The commonest site of obstruction was the junction of the lacrimal sac and the nasolacrimal duct (ninety cases; 53.2 per cent.), and the next commonest site was the sinus of Maier (41 cases; 24.3 per cent.). This observation agrees with that of Campbell (1964).

Condition of the sac In ten cases the dimensions were nearly normal, nineteen had small irregular sacs, and seventy showed dilatation (49 in all dimensions including the

FIG. 4 *Mucocoele of lacrimal sac with obstruction at junction of sac and duct*

FIG. 5 *Mucocoele of the lacrimal sac with partial block at junction of sac and duct. Some of the dye can be seen in the nasal cavity*

FIG. 6 *Mucocoele of lacrimal sac with diverticula*

vertical, and 21 in the lateral and antero-posterior diameters only, with reduction in the vertical diameter).

Abnormalities of the sac There were fourteen diverticula; in only one case were multiple diverticula seen on both sides. In all cases the diverticula were in the lateral wall, above and laterally (10) or below and laterally (4).

There were seven external fistulae (4.1 per cent.) and none internal.

There were no cases of filling defect.

(c) *Measurements of the sac*

These are shown in Table III (overleaf).

Table III *Measurements of the lacrimal sac in normal controls and pathological conditions*

Dimensions		Normal control	Cases with near normal dimensions 10 (11.1%)	Cases with dilatations 70 (77.8%)			Cases with small shrunken sacs 10 (11.1%)
				Dilatations in all dimensions 49 (54.4%)	Dilatation in antero-posterior and transverse diameters 21 (23.4%)		
Vertical diameter	Mean	11.10 mm.	8.9	12.9	7.0		4.5
	S.D.	±1.97	±1.51	±2.92	±1.14		±2.91
	S.E.	±0.33	±0.50	±0.42	±0.25		±0.31
Lateral diameter	Mean	2.43 mm.	1.95	5.98	4.4		2.6
	S.D.	±0.95	±0.52	±2.48	±0.82		±0.91
	S.E.	±0.16	±0.16	±0.36	±0.18		±0.30
Antero-posterior diameter	Mean	4.00 mm.	2.9	7.02	5.1		2.6
	S.D.	±1.49	±1.04	±2.59	±1.17		±0.66
	S.E.	±0.20	±0.34	±0.36	±0.26		±0.22

Discussion

Dacryocystography is a valuable aid in the diagnosis and management of lacrimal passage pathology. It reveals the living anatomy of the passages, changes due to disease, and the relationship of functional impairment to structural abnormalities.

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 to be retained while the radiological procedure is completed. Saha and others (1967) overcame this difficulty by using a very high concentration of dionosil in an aqueous base.

Our study of dacryocystograms in normal subjects enabled us to establish standard normal radiological appearances and measurements. These closely coincided with the dimensions reported in the text-books of anatomy (Duke-Elder, 1961) (Table IV).

Table IV *Relationship of normal lacrimal passage dimensions in the present series to those given in anatomical text books*

Area	Dimension (mm.)	Present study		Anatomical text books	
		Mean	Range	Mean	Range
Sac	Vertical diameter	11.10	6-14	12	—
	Lateral diameter	2.43	1-4	—	2-3
	Antero-posterior diameter	4.00	1-6	—	4-8
Nasolacrimal duct	Vertical diameter	20.97	13-26	17.7	—
	Lateral diameter	2.30	1-4	—	—
	Antero-posterior diameter	2.84	1-4	—	—

We observed an obstruction at the level of the sinus of Maier in 24.3 per cent. of cases, but Nahata (1964) and Castrén and Korhonen (1964) found this in only 5.7 and 15 per cent. respectively.

The information obtained about the site of the obstruction, the size and shape of the sac and the presence of diverticula and fistulae was a great help in case management.

Other observations were made in the course of the study. The left side was involved more commonly than the right, and the dacryocystitis was more common in women than in men (approximately 4 : 1). The latter is probably due to the narrower lumen of the lacrimal passages in females.

The peak incidence for females occurred in the forties while males showed a preponderance in the late twenties. The difference may be caused by the fact that specific infections are more common in males while females may suffer from chronic irritation such as that caused by smoke, etc., while cooking.

Summary

Dacryocystography was carried out in 37 normal subjects and 169 patients complaining of epiphora. Concentrated dionosil aqueous was found to give satisfactory results. The normal measurements for the lacrimal passages for Indian subjects have been determined. The value of routine dacryocystography before surgery is discussed.

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