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Radiologic Evaluation of Lacrimal and Orbital Disease

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Dysfunction or disease of the nasolacrimal ductal system (NLDS) is a common ophthalmologic problem, with the patient presenting with epiphora, lacrimal sac mass, or inflammation. The spectrum of disease varies from congenital absence or aberrancy of ductal structures to the more common acquired stenoses and obstructions of adulthood. Primary lacrimal sac and duct tumors are exceedingly rare. Infection is a much more common disease entity, especially in children and occasionally in adults. The radiologic lacrimal evaluation has evolved during the past 4 decades from x-ray dacryocystograms (DCG) to nuclear medicine isotope examination to CT and MRI evaluation. Some new techniques also have emerged from this past decade's increasing computer processor power, which, when applied to older CT methods, results in three-dimensional (3D) views of the NLDS. Orbital processes of particular interest to the oculoplastic surgeon are evaluation of Graves' dysthyroid orbitopathy and orbital wall trauma, which rely primarily on CT diagnostic techniques.

Plain-film radiographic evaluation relies on the Caldwell (posteroanterior) projection, the lateral view, and a Waters view of the orbits and paranasal sinus region. The Caldwell view details ethmoid and frontal anatomy, whereas the Waters view best demonstrates the maxillary sinuses. Conventional radiographs are still obtained as preliminary films for a DCG but are considered obsolete for the trauma patient [1,2]. DCG was first described by Ewing in 1909 [3]. Since the first use of the oil-based contrast agent lipiodol, the examination has evolved to use either water-soluble

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Sinografin iodinated contrast or newer non-ionic contrast media. The indications for DCG are numerous. This type of study generally is used to evaluate obstruction, tumor, trauma, or congenital abnormality. Acute dacryocystitis is a relative contraindication to DCG because of patient discomfort and the potential risk of infection associated with instrumentation of the infected lacrimal outflow system. In patients who have epiphora, DCG may be performed to determine the nature, degree, and level of obstruction or other pathology. A sialogram (Rabinov-type) blunt-tip catheter of appropriate caliber (21–30 gauge in diameter) is selected to infuse a small amount (1–2 cm^3 per duct) of non-ionic 61% iopamidol contrast (Isovue 300, Bracco Diagnostics, Princeton, NJ). Nonionic aqueous contrasts come in a variety of iodine concentrations, from 200 g/L to 370 g/L, and can be tailored to exposure technique and patient comfort level. Higher iodine concentrations may be more irritating to the patient, but water-soluble agents are preferred to oil-based compounds such as Ethiodol.

Macrodacryocystography using magnification fluoroscopy with bilateral injections should be considered as a routine study, because the asymptomatic side may be considered the patient's control normal, and the radiation exposure is not significantly greater than with a unilateral study. The quality of the DCG depends to a great degree on operator technique, because adequate contrast volume and flow, which rely on cannula position and size and contrast selection and use, are needed to define obstructions.

The advantage of digital radiography is the reduced radiation exposure to the patient when compared with conventional film-screen technique, at the cost of reduced resolution [4]. Other digital advantages are the ability to manipulate image contrast and brightness settings infinitely (manipulation that often is necessary with contrast DCG) and the ability to subtract the background structures from the image. The latter technique is referred to as digital-subtraction dacryocystography (DS-DCG) (Fig. 1) [5]. Complete filling of the normal nasolacrimal system generally occurs within 10 seconds and has one tenth the radiation dose per exposure as compared with routine radiographs [4]. Finally, both oblique frontal projections and slightly off-lateral views are obtained while injecting contrast through the ductal systems.

CT examination after contrast DCG study provides bony detail of the orbits and sinuses adjacent to the nasolacrimal system while allowing soft tissue density characterization of lesions within the duct, sac, or the eyelid and surrounding tissues. Three-millimeter cuts in the coronal and axial planes should be considered a minimal requirement, and newer multidetector techniques facilitate cuts as thin as 0.625 mm or less. Although the radiation dose can be as high as 5 cGY (1 cGy = 1 rad) for thin cuts of 1 mm or less, these slices offer superb anatomic detail necessary for the small size of the NLDS. A reduced electrical current (80 mA/s) technique is desirable to decrease patient radiation exposure, because it requires only one scan after contrast injection through bilaterally cannulated lacrimal systems, eliminating additional radiation for the coronal images. This technique is