Epiphora Decoded

The development over the years in understanding pathophysiology of Lacrimal System disorder has undergone a sea-size change. The improvement in stenting material, laser-advances and development of endoscopes has brought tremendous relief in patient care. Endoscopic-DCR surgery is on rise but external-Dacryocystorhinostomy (DCR) surgery, still remains the gold standard for many lacrimal surgeons. However significant doubts and controversies still exist in managing various lacrimal problems despite recent advances. The experts corner on lacrimal system disorders in this issue, presents the view of panel of Internationally acclaimed exports with immense experience in this speciality. The development over the years in lacrimal disorders regarding technique, diagnosis, stenting material, operative problems and their management are discussed at length by Dr. Vishnukant Ghonsikar with Dr. Choo Chai Teck, Dr. Reynaldo M. Javate, Dr. A.K. Grover, Dr. S.M. Betharia, Dr. Santosh Honavar, Dr. Neelam Pushker

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VG: How do you go about evaluating patients of epiphora? Any special investigations?

CCT: I would assess the severity and duration of the symptoms patient has and check any associated ocular symptoms. Slit lamp microscopy, probing and syringing are done before considering special investigations. CT scan or MRI is ordered if perisaccal pathology or surrounding bony abnormality is suspected. DCG is done for assessing the intraluminal lesion.

RMJ: The management of patients with epiphora begins with complete assessment of the external eye and eyelid. Careful inspection should distinguish the cause of excessive tearing as either lacrimal hypersecretion or mechanical occlusions to the drainage system and, thus, eliminate unnecessary surgery or result in erroneous surgical procedures.

Dutton and White presented an excellent summary of external ocular signs that may point to tear hypersecretion or reflex lacrimation as the primary reason for epiphora including: medial canthal swelling, discharge, and erythema (acute dacryocystitis); entropion and trichiasis (corneal irritation); ectropion with punctal eversion and/or exposure keratitis (lid laxity of aging or seventh nerve palsy); and corneal pathologies (erosions, ulceration, infections, retained foreign bodies) are possible reasons for excess tearing.
Findings that support partial or complete occlusion at some point along the lacrimal drainage include: punctal occlusion, punctal opposition, mass lesions near the medial canthal area, mucopurulent reflux, and nasal polyps among others.

Fundamental to the evaluation of dry eye or excessive tearing are the Schirmer Test, Rose Bengal, TBUT, Flourecsein Dye Disappearance Test, Jones I and Jones II Test, and canalicular probing.

**AKG:** After ruling out any eyelid/ocular surface abnormalities that may be causing reflex tearing or inadequate tear drainage, first step would be to establish the level of blockage in the lacrimal system. A simple regurgitation if present/ S&P in the absence of regurgitation would do that. A diagnostic probing and measurement of the level of obstruction are valuable tools in diagnosis. Special investigations like DCT/DCG are required in cases of epiphora post trauma/suspected sac malignancy or granulomatous disorders or cases with suspected functional epiphora.

**SMB:** I ask them whether any pain, watering, discharge and swelling in the area of sac. This tells me of acute or subacute dacryocystitis, watering gives me the clue that it is proximal system block, discharge tells me it is chronic dacryocystitis and swelling tells me that it may be mucocele. I do syringing only and do not conduct any special investigations. The clear fluid fluid from same punctum tells me about canalicular block, clear fluid from opposite punctum tells me about cc block and mucopurulent discharge from opposite punctum tells me that there is NLD block. Sometimes clear fluid with delay occurs and that also shows that there is NLD block. Other simple test will be to put the probe inside and if soft stop is their then it is CC block. We can measure the length of the probe going inside and determine the site of block at the canaliculus.

**SH:** If a patient were to have epiphora with discharge, I would straightaway look for regurgitation on pressure over the lacrimal sac (ROPLAS), which, if positive, will confirm nasolacrimal duct obstruction (NLDO). If not, I will rule out causes for pseudoeipiphora, look for punctal anomalies, and do fluorescein dye disappearance test (FDDT). If FDDT is prolonged, I will do diagnostic probing for canalicular anomalies, followed by lacrimal syringing. Nasal endoscopy is done as part of pre-operative work-up before lacrimal surgery. The need for DCG and scintigraphy is rare.

**NP:** A careful history and detailed ocular examination are very essential. I enquire about epiphora if it is unilateral/bilateral, intermittent/constant, whether tears flow onto the cheek, any associated discharge, and how it affects the patient. Frank regurgitation of discharge on pressing below medial canthal tendon confirms NLDO. In absence of regurgitation, look specifically for punctal atresia, stenosis and eversion. Rule out ocular surface disorder. Syringing and probing (S&P) tell us the level of block and guide in appropriate treatment. We reserve special investigation like CT-Dacryocystography for acquired NLDO following trauma or facio-maxillary surgery, in suspected sac tumors and dacryoscintigraphy to rule out functional blocks.

**VG:** Describe your way of doing syringing and probing (S & P) with respect to
a) Early vs late b) Method c) Additional measure* - s d) Post-op assessment e) When to repeat?

**CCT:** Depending on the age of presentation, lacrimal sac massage and antibiotic drop are prescribed before planning for S & P. Two c.c syringe with a round tip cannula and 2'O Bowman probe are used. Short sedation is preferred for the baby. Postoperatively short course topical antibiotic is continued and lacrimal sac massage is advised. Repeat S&P would be considered six months later if there is no improvement.

**RMJ:** Resolution of CNLDO occurs either spontaneously or with aide of massage and antibiotic drops in 80-95%. Probing is very effective in patients with persistent congenital NLDO if performed before 13 months of age. Beyond 12 months the success rate decreases.

In performing Syringing and probing I use the Javate Lacrimal Dilating cannula (gauge 23) manufactured by Eagle Labs (Rancho Cucamonga, CA 91730-5850), which is a blunt cannula with side port irrigation with the patient restrained by mummy’s wrap.

Post-operative assessment can be done with the use of Fluorescein dye Disappearance test.

I will do repeat S& P in patients who are still symptomatic.
AKG: I will do a S&P in a child with epiphora if it persists with conservative treatment after the age of 9-12 months. Probing should be done preferably through the upper punctum followed by syringing. Blocking the lower punctum during syringing is helpful. If watering is persistent, a repeat S&P can be done 3 months later. If first probing was unsuccessful in my own hands, I will consider doing an inferior turbinate infracture in the second intervention. An endoscopic assessment is extremely useful with therapeutic probing.

SMB: Regarding probing I prefer GA with intubation to open up the lower part of NLD. Select upper punctum and dilate it. Put 3-0 lubricated probe and feel the resistance of the medial wall and change the direction downwards, backwards and laterally. Be gentle to open up the block in the lower part of nld. Keep the probe there for a few minutes. The probe will not move if it is in correct place. I advocate probing between 6 months to a year. The late probing reduce the chance of success. It can be repeated after 4 to 6 weeks. Antibiotic ointment and drops for 2 weeks are given. This should be done by lacrimal surgeon.

SH: I would reserve early probing for children with imminent intraocular surgery (congenital cataract, congenital glaucoma etc), recurrent acute dacryocystitis needing systemic antibiotics and apprehensive parents. Otherwise, generally I would prefer to do probing after 6-9 months of age, and failure of properly performed hydrostatic sac massage for 3 months. Probing is done with an appropriate sized lubricated lacrimal probe inserted gently through the upper punctum and advanced in the anatomical direction until the membranous block is overcome. If there is a hard stop, then I would do graduated probing, reaming and boring. Nasal endoscopy to visualize the probe in the inferior meatus, medialization of the inferior turbinate where required, and silicone intubation when indicated help improve the success. Repeat probing is done only when the primary procedure has been performed elsewhere or a successfully opened membranous block comes to re-occlusion. There is no point in repeating probing in children with absolute bone block – they would need DCR.

NP: I explain the proper technique of sac massage first and follow up after 6 weeks. I prefer S & P for CNLDO after 9 months of age. Early S & P is preferred in selected cases where there is risk of corneal infection due to recurrent acute dacryocystitis. I perform S & P under general anesthesia with throat pack. I use Bowman probe set for probing after dilating the punctum with Nettleship punctum dilator. Spring back test to confirm the probe in NLD and additional reaming to increase diameter of NLD is done. One size larger probe should also be tried for further dilating the NLD opening. Absence of lacus lacrimalis and/ or discharge is good post-op indicator of successful S & P. If epiphora persists, a repeat S & P is performed after an interval of 2 or 3 months.

VG: Your opinion in managing CNLDO with repeated failed S & P with respect to
a) Probing ± intubation  b) Inferior turbinate fracture  c) Balloon Dacryoplasty

CCT: a) Probing and intubation is advised after failed S&P

b) Fracture is rarely needed if the inferior meatus space can be enlarged by gently pushing the turbinate medially.

c) Balloon dacryoplasty with tubing after failed intubation.

RMJ: Silicone intubation of lacrimal drainage system has been used for children who fail probing or are older. It has a good success rate but with significant drawbacks including the tube must be retrieved from the nose, removed 3-6 months after surgery hence requiring a second procedure, and elongation of the puncta may occur because of medial tension. Because of the significant drawbacks from conventional bicanalicular silicone intubation I have now switched to the use of MASTERKA (20-22, rue Louis Armand Paris France), which is a device with self-retaining punctal fixation. It consists of a single unit including a silicone tube with punctal plug and introducer. The silicone tube is cylindrical with one end closed and connected to a punctal plug. The introducer facilitates the insertion of the MASTERKA. The punctal plug is seated into the vertical canaliculus with the help of a plug inserter. The advantages of MASTERKA are ease of silicone intubation and patient’s comfort. The MASTERKA device is removed by pulling the silicone tube and the punctal plug from the upper punctum with a use of a forceps, thus difficult retrieval from the nose is avoided and cheese wiring does not occur because it is a monocanalicular intubation.

Balloon catheter dilation of NLD gives true dilation and is technically much easier to perform than silicone intubation and obviates the need to remove the tube or concerns about the child removing the tube. A high success rate can be
achieved. I use the OPHTACATH (20-22, rue Louis Armand Paris France) Lacrimal duct balloon catheter, which is available in 2 sizes; 2mm for patients under 30 months and 3 mm balloon diameter for patients over 30 months.

**AKG:** I would like to repeat a S&P in a child who comes with failed S&P done elsewhere and will do an infracture of the inferior turbinate along with it. Infracture is a wonderfully useful technique and obviates the need for silastic intubation in most cases in my hands.

**SMB:** In congenital dacryocystitis, in case you fail then intubation and inferior turbinate fracturing may help with the help of ENT surgeon. Balloon dacryoplasty sounds theoretical to me.

**SH:** Probing with intubation is specifically indicated in failed probing with fibrous stenosis, co-existing canalicular anomalies and in the presence of a large (atonic) sac. Inferior turbinate infracture (medialization) is indicated when it is malpositioned. Balloon dacryoplasty can be performed in failed probing with fibrous stenosis or partial bony block.

**NP:** Endoscopic visualization of nasal cavity to rule out inferior turbinate hypertrophy or narrowing of inferior meatus or congenital abnormalities is very essential in all cases of failed probing. If needed, inferior turbinate infracture must be done. In cases where there is still epiphora, I think silicone intubation of lacrimal system or balloon dacryoplasty both have similar results but latter is an expensive option.

**VG:** Your method of DCR surgery in CNLDO? (Indication, timing, differences from adults)

**CCT:** Either external DCR or endoscopic DCR in older patient who has failed intubation or recurrent dacryocystitis. If proper lacrimal sac massage, topical antibiotic, repeated probing and intubation have failed, by then the child would be more than 4 years old.

**RMJ:** My method of DCR surgery in CNLDO is Transcanalicular DCR or Endoscopic Lacrimal Duct Recanalization (ELDR) using microendoscope (KARL STORZ Tuttlingen, Germany), which is a minimally invasive approach to lacrimal system outflow problems. Lacrimal surgery that addresses the occluded ducts with minimal trauma to surrounding tissues can be performed using miniature telescopes (microendoscopes). A prime advantage of microendoscopy is precise localization of obstructions within the lacrimal drainage system and its mucous membranes. I use a microendoscope, 0°-Miniature Straight Forward semi rigid Telescope with incorporated high-resolution fiberoptic bundle (10,000 pixels), 110°-field of view and 0.85 mm outside diameter; Coupled to a 10-cc syringe and an extension suction tube and is connected to a xenon light source and to a three-Chip Camera Head. The camera head is connected to a Camera Control Unit (KARL STORZ Tuttlingen, Germany). I use a Lacrimal Trephine, which will pierce through and remove the obstruction in the lacrimal drainage system. Once recanalization has been completed, a Crawford Bicanalculus (20-22, rue Louis Armand Paris France), Intubation set or, a Ritleng Lacrimal Intubation Set (20-22, rue Louis Armand Paris France), is inserted to ensure the patency of the system, since without stent it would be unlikely to produce a persistent patency with recanalization In a long standing obstruction when a dense fibrous tissue has already developed.

I will do this in patients 3 years older after failed silicone intubation and balloon dacryocystoplasty. ELDR is similarly performed in patients with PANDO with or without canalicular obstructions.

**AKG:** I would do a DCR surgery in a child for CNLDO after 3 years of age. The surgery would be essentially the same as in adults except for the smaller anatomical structures. I don't do a routine intubation in pediatric DCR's.

**SMB:** In DCR for child the antero inferior opening should be made properly. It should not be too anterior to damage the nasal bone otherwise depression of the nasal bridge will result. The bony opening is likely to close faster and 3 yrs of age should be minimum. The bone punches should be sharp otherwise chances of spiral fractures will be there. Do not go posterosuperiorly in making bony opening and avoid damage to cribiform plate and bleeding due to ethmoidal artery. You must open the sac and confirm it by passing probe. Three suture anastomoses of anterior flaps should be done.

**SH:** I would do DCR in children when probing fails, and generally around 3 years of age. Early DCR is indicated in children with failed probing with impending intraocular surgery. I would do it exactly the same way as in adults respecting the anatomical boundaries of the osteum – junction of lacrimal bone and lamina papyrica posteriorly, 6-8 mm higher than the anterior lacrimal crest and until the periorbito-mucosa confluence anteriorly, exposure of sac-NLD junction inferiorly and 2 mm higher than the common internal punctum superiorly. The only additional measure would be to clear periosteum 4-5 mm all around the osteum and carefully ensure that there is no mucosal scaffold at the edges of the osteum.
NP: I always give a trial of probing in all CNLDOs before proceeding with DCR surgery. I prefer doing DCR surgery after the age of 4 years. Pediatric lacrimal surgery is almost always performed under general endotracheal anesthesia using a cuffed tube and a throat pack. I infiltrate the incision site with lidocaine and adrenaline for pediatric DCR cases as it helps in controlling bleeding. Identification of lacrimal fossa in younger children is sometimes difficult because of underdeveloped anterior lacrimal crest and shallow lacrimal fossa. This poorly defined lacrimal fossa can lead to inappropriate placement of the ostium site leading to failure. The surgical steps are almost same as in adult patients. Sometimes bony opening may not be as large as in adults. I do anterior flap technique in both adults and children. Maintaining homeostasis in children is very important as minimal blood loss also sometimes becomes significant in children. In primary DCR cases I don’t prefer to intubate the lacrimal system unless there is some problem in making a large osteotomy or fashioning proper flaps.

VG: How do you manage cases of congenital punctual atresia?

CCT: Assess any other abnormalities. Isolated single congenital punctual atresia could be conservatively managed. If there are associated canalicular atresia that involve both upper and lower canaliculi, placement of bypass tube is advised when the child is older.

RMJ: I manage congenital and acquired punctal atresia using a sharp punctum dilator followed by a larger punctum dilator and thereafter the insertion of the MASTERKA device (20-22, rue Louis Armand Paris France).

AKG: I would attempt to look for the possible punctal site and carry out a probing of the lacrimal system. If the distal system is patent, a perforated plug/ silastic intubation can be used/ a snip procedure can be done. If there is associated canalicular obstruction, a conjunctivo DCR (cDCR) can be done after 12 years of age.

SMB: Congenital punctal atresia and various abnormalities which are there can be managed by trying to dilate at the proposed site of punctum. Three and 4 snip operations can be tried.

SH: If the punctal block is membranous, it can simply be opened with or without punctoplasty. If the punctal dimple is present, I would attempt snip. If the punctal papilla is shallow, I would try decapitation and exploration for the remnant canalicular system. All these cases do well with monocanalicular intubation. If there is no punctal papilla at all, I would do a percutaneous retrograde DCG to see if the canalicular system is developed. If so, there is a case for canaliculostomy. If not, the child would need a Jones tube when older.

NP: If punctal papilla is visible then I perforate the punctum using a fine tipped punctum dilator or tip of 26G needle. If it opens then snip procedure with intubation. In such patients the rest of the canalicular system is usually normal. In patients with no punctum or papilla, the canalicular system is usually obliterated. Retrograde passing of Bowman probe through common canaliculus and cut-down of canaliculus onto the probe tip followed by intubation has been described but I prefer doing conjunctivo-DCR preferably after the age of 18 years.

VG: Your pearls about managing congenital lacrimal fistula?

CCT: Treat dacryocystitis in early childhood. Dacryocystorhinostomy and intubation +/- fistulectomy for recurrent dacryocystitis. A good patent DCR is essential for long term success and symptomatic relief.

RMJ: A congenital lacrimal sac fistula, with an abnormal connection from the skin to the lacrimal passage, is a rare developmental disorder. Fistulae originate mainly from the common canaliculus and occasionally in the lacrimal sac, and they are detected by dacryocystogram, computed tomography, insertion of a probe into the skin opening and polyvinyl siloxane casts. However, these procedures are frequently inaccurate and/or invasive. I perform Dacryoendoscopy using Microendoscope (KARL STORZ Tuttlingen, Germany), which allows clear and direct observation of the lacrimal passage by a procedure similar to probing. The procedure does not require invasive manipulations such as incisions to the skin or nasal mucosa. Furthermore, I could simultaneously treat the nasolacrimal duct obstruction by performing ELDR, which sometimes presents in cases of congenital fistula, with the trephine and the microendoscope. Dacryoendoscope efficiently and accurately enables the detection of a fistula origin and can also be utilized for the treatment of congenital lacrimal sac fistula where I probe with the tip of the dacryoendoscope, then the fistula is dissected and traced to its origin as a core, and then I ligate its base and then completely excise it.

AKG: If the fistula is present along with NLDO, the NLDO should be managed first according to the child’s age. Fistulectomy can be done if the child is being taken up for GA for either a S&P or for DCR. If there is no associated NLDO,
fistulectomy can be done electively at any age. It is essential to remove the fistulous track along its entire length as far as possible and close the space from deep to skin level. In my experience, most cases of congenital fistula have not been associated with NLDO.

**SMB:** Congenital lacrimal fistula can be dealt with by fistulectomy and closure of fistula. If nld block is there then DCR will be needed.

**SH:** If there is associated NLD block, I would do probing followed by fistulectomy. Or else, simple fistulectomy would be perfect. The skin incision is kept elliptical, a probe is passed through the fistula and the tract excised until it funnels out into the sac. Purse-string suture is placed at the cut end and the skin-orbicularis are closed.

**NP:** These patients usually have normal development of rest of their excretory system. Asymptomatic lacrimal fistulas do not require treatment. For symptomatic lacrimal fistula i.e., tears coming out from the fistula, always rule out associated NLDO. If patient has no sign and symptoms of epiphora and/ or discharge then fistulectomy can be safely deferred till any age. In patients with associated NLDO, fistulectomy with NLDO probing or DCR (according to age) should be performed.

**VG:** Your management options for acquired lacrimal punctal stenosis?

**CCT:** Office punctal dilation. V snip punctoplasty if restenosis occurs after repeated dilation. Consider punctal mucous membrane grafting with stent if the punctoplasty fails.

**AKG:** I will attempt a punctal dilatation and perforated punctal plug or minimonoca tube insertion. If that fails, a single snip or three snip procedure would be the next step. Where these procedures do not work, I would use Botox injection in palpebral part of lacrimal gland. Some cases may require cDCR.

**SMB:** Proximal canalicular block can be treated by intubation DCR if the block is more than 5 mm from punctum. Please note that all intubation procedures are likely to fail and it is like walking with crutches. So explain the chances of failure to the patients.

**SH:** I would try to identify the cause and revoke it if possible. If the stenosis is mild, aggressive dilation with moncanalicular perforated stent would help. If severe, I would do a snip punctoplasty. In patients with cicatricial disorders, adjuvant mitomycin-C may be used.

**NP:** Ocular surface disorder should be ruled out. I usually find associated meibomian gland dysfunction in these patients which I treat first. If patient shows no response then I perform snip procedure with eyelid tightening surgery if significant laxity is present. Punctal dilatation with a stent (self –retaining or mini monoka canalicular stent) is also a good option.

**VG:** Explain your way of managing proximal canalicular block (< 8 mm)

**CCT:** Assess the extent of block and check any remaining patent canaliculus. If the block can be removed and there are healthy patent canaliculi on both side of the block, these ends are reanatomised and stent is applied. Canalicular trephine is used for localized area of block before intubation, but a bypass tube will be the last option.

**AKG:** In cases of trauma with localized scar tissue, canalicular trephination with silastic intubation is sometimes successful. Injection botox in the lacrimal gland can be an alternative to decrease the epiphora which works in a significant percent of cases. Where this is not successful a cDCR is carried out.

**SMB:** Regarding acquired punctual stenosis, find the cause and treat the cause. Dilate punctum and do snip operation. punctal and canaliculus can be opened and the result may be rewarding.

**SH:** Trephination with Sissler’s trephine and moncanalicular intubation is standard. If the block is extensive, and bicanalicular, then a conjunctival DCR with Jones’ tube.

**NP:** I try to open the canalicular block with a fine probe, if it opens then intubation is necessary to maintain the patency. In cases where it does not open I do conjunctivo-DCR.

**VG:** Describe your method of conj-CDR? Which tube you use for conj. DCR?

**CCT:** Direct transcaruncular bypass tube insertion with endoscopic nasal cavity assessment. If larger space is necessary for proper tube placement, turbinectomy can be done. Pyrex Jones tube is recommended.
RMJ: I perform CDCR, which is a Dacryocystorhinostomy, performed in conjunction with placement of a total lacrimal bypass tube.

After exposing the lacrimal fossa, attention is directed toward placement of the tube. A linear slit is made in the caruncle or subtotal removal of the caruncle is performed so the tube will be well situated in the nasal end of the interpalpebral fissure. A large gauge needle, von Graefe knife, or 15 blade is passed into the nose through the caruncular slit and osteotomy in an anteromedial and inferior direction. The tip of the instrument should be located anterior to the top of the middle turbinate. The intranasal septum should be sufficiently away from the lateral wall of the nose for adequate space of the distal end of the tube. A fine Quickert-Dryden lacrimal intubation probe is placed through the needle lumen into the nose. As the needle is withdrawn from the nose, the distance from the caruncle to the nose should be measured, to determine the length of the tube needed. Alternatively, the probe can be passed through the opening made with the knife or blade. The probe is used as a guide for passing the glass tube directly into the nose. A suture placed around the neck of the collar or through the fixation hole in the collar to anchor the tube to adjacent tissues. Another method for placing the tube is to use a glaucoma trephine over a solid guide.

I now use the new Stoploss Jone tube system (Penny Lane, Wargrave, Berkshire, UK), which puts an end to high loss rate of ordinary Jones tubes.

AKG: I do an external DCR with a relatively smaller osteum. Following this, I pass a bent hypodermic needle through the caruncle to make the track for the tube and a lacrimal probe is used to calculate the length of the tube required. The cDCR tube is inserted along this track over a lacrimal probe. I use a Jone’s tube made indigenously using borosil glass. I have recently started insertion of the tube directly avoiding a DCR, using a thick hypodermic needle to create a track from the caruncle and passing the tube under endoscopic control.

SMB: For CDCR the indication will be total stenosis, blockage of proximal lacrimal passages. I use Jones Pyrex glass tube. The length of the tube should not touch the nasal septum and should be 2 mm short of that. The tube should be placed in such a way that when drop of saline is put it should drain down easily. Read my article for many details titled comparative evaluation of Jones Pyrex glass tubes and polyethylene tubes in conjunctival DCR in IMO.

SH: I would do a closed technique using a 16-gauge needle under the caruncle, inserted to guide the Jones’ tube into position, and monitored endoscopically.

NP: I follow standard steps of surgery. Unlike DCR, a smaller bony osteotomy is made. The caruncle is excised and a port is made with the help of an 18G needle or MVR blade. A lacrimal probe is used to measure the length of the tube needed. The distance from the medial canthus to the nasal septum minus 2 mm is the length of the bypass tube to be used. The tube is inserted using a probe as a guide wire and collar is positioned at the level of excised caruncle. I routinely fix the tube with medial canthal ligament using 6-0 non-absorbable suture. At the end it is important to check that the collar of the tube is not causing undue pressure on the sclera or protruding too much on the conjunctival side. I prefer using high-density porous polyethylene-coated tear drain tube. Kindly read the article – ‘Pushker et al. Conjunctivodacryocystorhinostomy using a high-density porous polyethylene-coated tear drain tube. Int Ophthalmol. 2013 Aug;33(4):329-33’.

VG: Management of distal canalicular block (> 8mm) with respect to

a) Canaliculo – DCR; b) DCR with intubation c) pericanalicular dissection d) Any other method?

CCT: a) Canaliculo-DCR for distal obstruction, b) DCR with intubation when the common canalicular block is found during probing. c) Intraoperatively peri-common canalicular stricture can be removed. d) MMC application for potential scarring and restenosis.

RMJ: I perform microendoscopic-guided Canalicular trephination with silicone Intubation for Canalicular obstructions (< 8 mm and > 8 mm) similar to performing an Endoscopic Lacrimal Recanalization.

The upper and lower puncta of the eye ipsilateral to the obstructed canaliculus are enlarged with a punctum dilator. A 4-0 Bowman probe is advanced into the canaliculus until a point of “soft-stop” is encountered, setting an approximate localization for the obstruction that should be visualized. The probe is removed and replaced with the JAVATE lacrimal trephine (KARL STORZ Tuttlingen, Germany), the tip of which is advanced to reach the medial wall of the lacrimal sac. A fiberoptic microendoscope (KARL STORZ Tuttlingen, Germany) with a 0.65 mm-external diameter is inserted into the 0.7
mm-diameter lumen of the trephine, and carefully advanced to the stenotic tissues. Once the tissues are actually visualized, trephination is initiated by gently rotating the instrument. Real-time video images of the trephination have proved to be very helpful in preventing creation of false passages that would otherwise occur with blind instrumentation. Irrigation is then performed to confirm restoration of patency of the trephined canalicular lumen and to assess the condition of the nasolacrical duct after the point of obstruction. In the presence of stenosis extending beyond the point initially treated by trephination, the surgeon proceeds either with ELDR or External DCR using silicone intubation. A bicanalicular silicone intubation (Ritleng lacrimal intubation) set (S1-1450) is passed through both the upper and lower punctum into the corresponding canaliculi and are retrieved beneath the inferior turbinate. The ends of the silicone tubes are secured with a retinal buckle to prevent the tubes from slipping into the NLD.

I manage purely canalicular obstructions by intubation with self-retaining stent, such as the Autostable bicanalliculus intubation set with disposable dilator SRS (FCI, 20–22 rue Louis Armand, 75015 Paris, France) with flexible winglets and guides that facilitate placement and anchorage within the canaliculi.

AKG: In cases of distal canicular block I would either overcome block with a probe or excise the blocked distal segment and intubate the lacrimal system. Adjuvant MMC can be used to decrease the chances of re blockage prior to intubation.

SMB: Distal canalicula blocks are well treated by intubation DCR. You can use guibors intubation, crawfords tube or Bodkins tube. Handle the junction of the stainless steel stelate and the silicone tube gently and careful and knot the tube in the nose with 6-0 vicryl. Keep the loop of the tube small so that cornea is not rubbed by it. The tube should not be too tight so that there is no slitting of the punta and canaliculus.

SH: All these can be attempted but with limited (60-70%) success. If these fail, then Jones’ tube.

NP: Common canaliculus (CC) block at the medial end (sac-CC junction) is usually membranous and can be pierced or excised followed by intubation DCR. CC obstruction at the junction of upper and lower canaliculus requires excision of the blocked canaliculus with anastomosis and intubation DCR (also known as canaliculo-DCR with intubation).

VG: Describe your method of doing adult DCR Surgery with respect to

a) Incision  b) Osteotomy size and extent  c) Breaking bone  d) Surgery flap modification

CCT: a) Small skin incision (less than 10mm). b) Well sited large osteotomy of about thumb nail size. c) Thick frontal process of maxilla can be easily removed by Kerrisone Rongeur bone punch. d) Suture the posterior flap only for better hemostasis.

AKG: I prefer an incision 3mm away from the medial canthus. The osteotomy should extend superiorly up to the level of the medial canthus, inferiorly up to the sac NLD junction and anteriorly the anterior lacrimal crest should be removed. I prefer using a bone punch for making an osteotomy. Anastamosing both anterior and posterior flaps is ideal and I would do it in cases with large flaps and minimal bleeding. However in difficult cases, only anterior flaps is a good option.

SMB: For adult DCR the incision should avoid angular vein, it can be anterior and straight and will avoid bow string appearance and psedoepicanthal fold formation. Sometimes the scar of anterior incision shows off clearly. I would like to emphasize 3 important things in DCR. They are 1) opening of the sac correctly and its conformation by passing of the probe. 2) making of anteroinferior bony opening in the dependent position of 12 mm size. 3) good 3 suture anastomoses of anterior flaps with 6-0 vicryl sutures and keeping the flap taut. You can excise the post flap of the sac and make only ant. Flap of nasal mucosa.post flap suturing is not required.

SH: Incision is 8 mm curvilinear along the anterior lacrimal crest.

Osteotomy is bound by anatomical considerations – not to worry too much about the size. If the anatomical criteria are met, the size is generally more than adequate. The limits are junction of lacrimal bone and lamina papyrecia posteriorly, 6-8 mm higher than the anterior lacrimal creast and until the periosteum-mucosa confluence anteriorly, exposure of sac-NLD junction inferiorly and 2 mm higher than the common internal punctum superiorly.

I would use graduated punch for bone removal.

I excise the posterior flap and suture only the anterior flap.
NP: I prefer giving skin incision at 3 mm distance from medial canthus because of better accessibility and hidden scar. For punching bone I use bone rongeurs. Osteotomy size should be approximately 14 x 14 mm extending superiorly till medial palpebral ligament, inferiorly till sac-NLD junction and posteriorly upto posterior lacrimal crest leaving a rim of 1 mm bone at posterior lacrimal crest in order to avoid injury to it. Anteriorly, it is quite safe to enlarge osteotomy which can extend 4-5 mm in front of anterior lacrimal crest but one should not punch suture line between the frontal process of maxilla and the nasal bone. I make single, anterior-flap of lacrimal and nasal mucosa and excise rest of it. I routinely hitch the flap to periosteum or soft tissue using 6-0 absorbable suture near anterior bony opening to prevent its falling back and closing ostium in post-operative period.

VG: What precaution you take for hemostasis? (Pre-op/ intraop/post-op)

CCT: Stop anticoagulant 5 days preoperatively. Small skin incision/ good tissue separation/ traction, surgical patties (1x0.5 inches) soaked with diluted adrenaline to pack and dab the oozing tissue plus suction probe are used. They provide fairly dry surgical field. Postoperative nasal co- phenylephrine nasal spray/ or packing are applied if bleeding is expected.

RMJ: I described a technique which I call the mini-incision DCR, which is 8-10 mm in length, placed approximately 7-8 mm beneath the lower eyelid margin, using a DCR electrode that I use for transnasal DCR or a fine wire electrode, attached to a radiofrequency unit, extending just onto the anterior lacrimal crest, continuing laterally in a horizontal direction following the periorbital relaxed skin tension lines. This incision significantly diminishes bowstringing and postoperative scarring. This approach of following the relaxed skin tension line yield superior cosmetic results in patients in all ages. Steps in Mini-Incision DCR: Skin marking is placed 7-8 mm below the lower lid margin. The procedure can be performed under local or general anesthesia, based on patient’s age, medical condition, or personal preference. The skin is incised with an RF electrode in the cut mode and the underlying fiber bundles of the orbicularis muscle in the coagulation mode. Hemostasis is achieved by touching the fine forceps holding the bleeding points, with the RF electrode. The periosteum is also incised using the RF electrode.

The periosteum is reflected off the anterior lacrimal crest down to the lacrimal fossa with a Freer periosteal elevator to maximize exposure of the lacrimal sac. A Kerrison punch, inserted between the nasal mucosa and the maxillary frontal process is utilized to create a 15 mm x 15 mm osteotomy. Next, tenting of the sac is done using a Bowman probe. A stab incision is made into the sac using a sickle knife. A Jameson muscle hook is inserted into the lumen of the sac. The muscle hook lifts both the inner mucosa and loose outer covering of the lacrimal sac, and guides the incising blade from the fundus of the sac to the nasolacrimal duct. 2% xylocaine mixed with 1:200,000 epinephrine solution is injected into the nasal mucosa. Using the electrode the nasal mucosa is incised to create H-shaped flap that mimics and complement the lacrimal sac flaps. The posterior flaps of the lacrimal sac and nasal mucosa are apposed with one or two interrupted sutures using 6-0 Vicryl (polygalactin) suture. Next, bicanalicular intubation is done using Crawford Bicanalicular Intubation Set or Ritieng Lacrimal Intubation Set or the new FCI Nunchaku stent (FCI, 20–22 rue Louis Armand, 75015 Paris, France). With the, Nunchaku stent, the metallic guide is located inside the lumen, not as an extension of the stent as in conventional intubation sets. What’s great about it is, no knots, sutures, or retinal buckle, which can cause collection of dirt, are needed at the end of the procedure, and no retrieval from the nose is needed. Anastomosis of the anterior flaps created from the nasal mucosa and the lacrimal sac, is performed using 5-0 (Vicryl) polygalactin sutures. A 6-0 prolene suture is used for skin closure either in continuous running or subcuticular fashion.

The surgical duration was significantly shorter in mini-incision DCR using the radiosurgery unit, which provides excellent hemostasis, producing optimal visualization thus relatively shorter operative time.

AKG: Control of blood pressure, stoppage of NSAIDs and anticoagulants, checking PT and APTT and exclusion of nasal pathology is important. Pre op decongestant nasal drops on the day of surgery and nasal packing done with 1:50,000 adrenaline solution helps to decrease the chances of bleeding from the nasal mucosa. Intra op some measures can be used for improving hemostasis including local anaesthesia with lignocaine and 1:80,000 adrenaline and waiting for about 10 minutes after block before starting surgery. It is important to work in the right planes. The nasal pack is retained for 24 hours post operatively.

SMB: Precautions for haemostasis will be to avoid aspirin and stop the anticoagulants before surgery, always do routine bleeding and clotting time. During surgery avoid the sources of bleeding that is angular vein, nasal mucosal and bleeding through bone you may use cautery judiciously, ligate vessels and rarely will need bone wax.
SH: The patient should be off anticoagulants for a week and BP should be under control. Good block, nasal decongestive drops, nasal pack, head-end elevation, and powered suction are helpful. Post-operative nasal pack is useful.

NP: I start xylometazoline nasal drops, 1 hour before the surgery, 2-3 times with nasal packing 10-15 minutes before starting surgery. Intra-operatively, unnecessary dissection medial to anterior lacrimal crest should be avoided to prevent bleeding from soft tissues and rupture of angular vessels. Bipolar cautery should be used to prevent excessive blood loss. Careful punching of bone is very important i.e., mucosa, soft tissues and periosteum should not come in the punch. Mostly nasal mucosal bleeding can be stopped by repositioning the nasal pack in middle meatus which directly tamponades the bleeding vessels. Post-operatively, nasal pack is left in place with bed rest for 24 hrs. Needless to mention pre-operatively careful history including drugs which affects coagulation profile and investigations to rule out bleeding disorders and other systemic disorders are must in all the cases.

VG: What is your opinion about role of a) intubation b) MMC in DCR?

CCT: Intubate if there is potential canalicular stricture. Tube can be easily removed earlier postoperatively if it is not required. MMC is used for all repeat DCR cases and potential scarring around the common canalicular orifice.

RMJ: Silicone intubation is recommended in patients with concomitant canalicular obstruction. Although, I routinely use silicone intubation in all my patients after standard External DCR, Endoscopic Endonasal DCR, and Transcanalicular DCR or ELDR. I use Mitomycin C for revision External DCR and revision Endoscopic Endonasal DCR.

AKG: I intubate the lacrimal system in cases of DCR with distal canalicular/common canalicular obstruction. I don’t think it has any additional role in pediatric or post traumatic DCR’s. Intra operative MMC can be used as an adjunct in cases with distal/common canalicular obstruction after releasing the block and in failed/ traumatic cases. I do believe that it helps in the cases where there is a greater chance of fibrosis. I use 0.4mg/ml for a duration of 4 minutes.

SMB: MMC will help in failed and post traumatic cases. Intubation is required in canalicular, CC block, encysted mucocele, failed and post traumatic cases for good results.

SH: Intubation in DCR is indicated when there is co-existing punctal or canalicular problem, intra-sac fibrosis around the common internal punctum, complications related to the lacrimal sac or nasal mucosal flap, or in prior failed DCR situations. MMC is used intra-sac fibrosis around the common internal punctum, complications related to the lacrimal sac or nasal mucosal flap, or in cases with prior failed DCR.

NP: I strongly doubt role of intubation in primary DCR surgeries. I avoid intubation in pediatric, post-trauma and failed cases also where bony osteotomy is large enough. I use it in cases with canalicular stenosis or where bony opening is not adequate or where the flaps cannot be fashioned or in presence of extensive fibrosis. I use mitomycin C as an adjunct in repeated failed DCRs with extensive fibrosis.

VG: Your opinion about transcanalicular laser DCR?

CCT: Good outcome has been reported but the laser energy usage and scarring are the concerns. What is the optimal osteotomy size? Is the postoperative care not as simple as external DCR?

RMJ: Lasers came into use for the transcanalicular DCR approach. However, most studies of laser-assisted transcanalicular DCR, reported lower success rates.

AKG: I have done very few cases of transcanalicular laser DCR. My feedback from most surgeons is not very positive about the long term results. It is possibly still an evolving technique.

SMB: Transcanalicular DCR with laser with intubation works but gold standard is external DCR.

SH: A big failure, with long-term success no better than 50%

NP: Transcanalicular laser DCR came with a bang but increasing report of long term failure are alarming. I strongly doubt its long term efficacy.

VG: When & how do you do DCT?

CCT: Intraluminal lacrimal sac tumor case after assessment. Good tissue separation as in initial DCR approach without osteotomy. Intraoperative frozen section is done before proceed to total dacryocystectomy.
**RMJ:** I do not request for Dacryocystogram, instead, I perform Dacryoendoscopy to directly visualize the lumen of the lacrimal excretory system.

**AKG:** I do a DCT only in cases of suspected sac malignancies or sac granulomatous inflammation. Complete dissection and excision of sac with ligation of sac NLDO junction is carried out.

**SMB:** I do DCT in malignancy, extremely old people and sometimes in encysted mucocele if patient does not want intubation DCR.

**SH:** I would do DCT for lacrimal sac tumors or granuloma unresponsive to medical treatment, NLDO where DCR is contraindicated for local or systemic reasons and in patients with NLDO needing expedited intraocular surgery. I would do a clean radiofrequency-device assisted DCT, dissecting the sac out and excising it along with a long stump of NLD. I would also cauterize the puncta.

**NP:** DCT is a simpler procedure but should not be done in cases where DCR is indicated. There are limited indications for DCT such as sac malignancy, sac rhinosporidiosis or recurrent dacryocystitis in patients with severe dry eye e.g. post Stevens-Johnson syndrome. In DCT it is very essential to ensure that sac has been completely excised along with NLD mucosa as far as possible. Piecemeal removal of sac mucosa should be avoided as residual mucosal epithelium may regenerate leading to recurrence of problem.

**VG:** How do you go about managing canalicular injuries? (Timing /cut-end Identification/ role of pigtail probe)?

**CCT:** Any time after 24 hours. Managing canalicular injuries is a microsurgical procedure.

If the canaliculus is avulsed from the sac and the medial cut end is so distal that become impossible to visualized during microscopic wound exploration, then an retrograde probing through a DCR approached (without osteotomy) opened sac is applied. I do not use pigtail probe.

**RMJ:** I prefer to use the MASTERKA device for stenting the lacerated canaliculus again because of ease of silicone intubation, patient’s comfort, and no need of retrieval from the nose and cheese wiring does not occur because it is a monocanalicular intubation.

**AKG:** A canalicular injury should be repaired as soon as possible after injury without compromising on a proper operation theatre set up or assistance. The cut end is usually visible in fresh cases and can be confirmed by putting a probe through it. If not clearly visible air is injected from the opposite punctum in a pool of saline, while pressure is applied on the sac region. I m not a great fan of pig tail probe.

**SMB:** In canalicular injuries earlier is better. Let the edema subside. Identify cut ends seen as pearly white by microscope. Use original Morrison technique of passing air and the bubbles come out.

**SH:** I would perform surgery for canalicular injuries as soon as logistically feasible. I would use high magnification of the operating microscope to identify the cut end and rarely use a pigtail probe. Once the medial cut end is identified, I would do monocanalicular intubation and then pass pericanalicular sutures, and then go on to repair the orbicularis and skin.

**NP:** Perform complete periocular and ocular examination to look for any other injury. Repair of canalicular injuries should be tried irrespective of timing of presentation. However, best results are possible within 24 hours of injury. Under magnification, in fresh injuries, the medial cut end of canalicular mucosa can be easily identified. In cases with delayed presentation injection of air or dye is helpful in localizing the severed end. I avoid use of pigtail probe for any lacrimal surgery. I use a monocanalicular stent unless the CC is severed where bicanalicular intubation is needed.

**VG:** Which intubation material you prefer for canalicular injuries? Why?

**CCT:** Several materials and designs are available in the market, but I still prefer Crawford silicone tubing because it is time tested. It is stable and postoperative management is simple. Removal is simple too.

**RMJ:** I perform repair of canalicular laceration within the first 24-48 hours after injury, preferably within the first 24 hours.
For cut end identification, I instill 10% Phenylephrine into the medial canthal area to help identify the proximal end of the lacerated canaliculus. This gives the appearance of the proximal cut end of the canaliculus, a rolled white edges and a shiny epithelial lining.

**AKG:** I normally use a mini monoca tube for canalicular injuries. If unavailable, I use a Teflon tubing of intravenous intracath. With this tube it is important to do skin fixation with a double arm suture like prolene. I additionally pass this double arm suture upward and medially with an additional bite and tie over a bolster. This gives an upward and medial vector and prevents extrusion of the tube.

**SMB:** I put the stent of 23 gauge of venflon tubing or various intubation techniques to do peri canalicular suturing with 10-0 nylon, give traction suture in the lower lid and keep the stent for 6 weeks delay will give poor results in all cases.

**SH:** I prefer monocanalicular intubation because of the ease of use and punctum-based fixation.

**NP:** If available, I use mini-monoka canalicular stent or else self retaining uni- or bicanalicular stents, silicone intubation set, prolene suture, silicone sling rod or intravenous catheter tube (neoflon) etc can be used as a stent but these stents need to be sutured to the skin to prevent corneal injury.

**VG:** Your opinion about endonasal DCR?

**CCT:** It has good long term result as external DCR, and avoids a skin incision. It incurs higher cost and requires learning skills. It is useful for some cases of subacute dacryocystitis which may not resolve after adequate medical treatment that has a risk of developing another acute attack before external DCR can be carried out.

**RMJ:** Endoscopic endonasal DCR is a widely used technique now for DCR surgery, however patency rates in endoscopic endonasal DCR generally varies from 50% to 100%, among different series, which has led to skepticism amongst the ophthalmological community, general anesthesia is preferred, requires familiarity with the intranasal anatomy, technically challenging and involves a steep surgical learning curve.

**AKG:** Endonasal DCR is certainly a good technique which all oculoplastic surgeon must learn. The results are getting better and better, though external DCR remains the gold standard. Endonasal DCR is particularly useful in revision surgery for early failures.

**SH:** Endonasal DCR is work in progress. It is taking time to evolve to be as successful as external DCR, and once it does, I would probably convert.

**NP:** I do external DCR which still is considered the gold standard. Learning endonasal procedures is an additional advantage to oculoplasty surgeons as it helps in knowing the causes of failure and treating them.

**VG:** Any recent advances for general ophthalmologist?

**CCT:** Microendoscopy dacryoplasty for treatment of nasolacrimal duct mucosal stricture. It looks promising by some experts. But if the adult acquired nasolacrimal duct obstruction is a progressive involutional changes, will this provide a long term cure?

**RMJ:** In 1995, I pioneered the Endoscopic Radiofrequency-Assisted DCR (ERA-DCR).

In more recent years, with the emergence of microendoscopes, I have stepped up the development of dedicated microendoscopic equipment to further refine lacrimal microendoscopy.

Endoscopic Lacrimal Duct Recanalization (ELDR) Using Microendoscope offers several advantages. It is effective: high success rate 96.2%, in terms of anatomic patency, safe: no major complications, simple: minimally invasive technique, no skin incision, can be performed under topical and local anesthesia as an office based procedure, easy: easier to learn than endonasal DCR, relatively fast procedure 10 -15 min and allows concomitant management of canalicular obstruction and provides an alternative treatment choice for elderly patients who are poor surgical candidates.

**AKG:** I think the biggest advance with a great future is the endocanalicular, endoscopic recanalization techniques. In time this potentially is the technique that will take over as the first choice.

**SH:** Canalicular endoscopy and ultrasound bone emulsification for DCR are exciting.
Role of canalicular endoscopes (canaliculoscope) for visualizing canaliculi, lacrimal sac and NLD is quite fascinating. The future will bring not just technical improvements in surgical methods, but also a better understanding of the causes of epiphora and treatment will become less invasive.