Brief Insight about Trans-Canalicular Laser-Assisted Endoscopic Dacryocystorhinostomy

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Abstract

Background: Dacryocystorhinostomy (DCR) means creation of anastomosis for direct communication between the lacrimal sac and the nasal cavity through a bony ostium. There are different surgical techniques available for DCR. These include external DCR, endomechanical laser DCR, endonasal laser DCR, and transcanalicular laser-assisted DCR. Diode laser-assisted DCR offers many and specific advantages over conventional DCR. Recently, minimally invasive techniques like transcanalicular laser-assisted endoscopic DCR have gained popularity. Currently, this procedure is performed with an incision-free technique that avoids visible scarring, requires shorter operating time, produces less bleeding, and is easier to learn than other DCR methods. Overall, the success rate of laser-assisted endoscopic DCR in relieving epiphora is reported to be between 60 and 90 percent. The procedure is usually performed in patients who are concerned about external scarring and want a minimally invasive procedure. Furthermore, it is advantageous for patients who have bleeding disorders or must remain on anticoagulation medication. It is contraindicated in patients who have lacrimal or nasal sinus neoplasia. Relative contraindications include dacryolithiasis, canalicular obstruction, and canaliculitis. In addition, caution is needed in patients with altered nasal anatomy. Imaging studies are recommended to evaluate such patients to determine the nasal bony anatomy prior to surgery in selected cases.

Keywords: Trans-Canalicular, Laser-Assisted, Endoscopic Dacryocystorhinostomy

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Introduction:

Chronic dacryocystitis is chronic inflammation of lacrimal sac and its most common cause is occlusion of nasolacrimal duct. If untreated, it may cause recurrent conjunctival inflammation2, dacryocoele, lacrimal sac fistula and even orbital cellulitis. Treatment of choice for chronic

dacryocystitis is dacryocystorhinostomy (DCR) in which a permanent passage is created between lacrimal sac and nasal cavity. DCR through external approach, due to high success rate (>90%) remained the gold standard technique for decades.3 Caldwell in 1893 described an alternative to DCR by doing it via endonasal approach with the help of nasal endoscope. Later on, because of the innovation of higher resolution fiber optic nasal endoscopes, endoscopic DCR started becoming popular. The recent advancement in DCR technique is doing it via transcanalicular approach, in which osteotomy is created with the help of diode laser. Diode laser assisted TC-DCR has some additive advantages as it can be done under local anesthesia, causes precise cutting and removal of tissue by ablation, is bloodless, less time-consuming, leaves no external scars and can be repeated. It can also be used to treat failed Ex-DCR. **(Mor et al., 2018).**

Dacryocystorhinostomy (DCR) means creation of anastomosis for direct communication between the lacrimal sac and the nasal cavity through a bony ostium and thus to reestablish lacrimal outflow by creating a bypass into the nasal cavity. There are different surgical techniques available for DCR. These include external DCR, endomechanical laser DCR, endonasal laser DCR, and transcanalicular laser-assisted DCR. External surgical DCR has been a successful surgery in the treatment of nasolacrimal duct obstructions (NLDOs) since many years but with it s limitation like prolonged surgical time, unpredictable bleeding, and external scar. recently, minimally invasive techniques like transcanalicular laser-assisted endoscopic DCR have gained popularity. The first endoscopic DCR was described by Caldwell (1893). However, the endoscopic technique was not successful because of difficulty in visualizing the endonasal anatomy, but in last two decades, the development and use of newer generation rigid nasal endoscope provides better view of nasal cavity , even allowing the visualization at angles from direct visual axis and thus gaining popularity.The last step in the development of less traumatic DCR is the endocanalicular/transcanalicular approach. In this approach, first described in 1963 by Jack,[2] a probe is inserted through the lower lacrimal punctum via the canaliculus into the lacrimal sac following the anatomical pathway of tear outflow . Osteotomy is performed either by a mechanical drill or laser energy through an optic fiber, which is inserted within the probe. The first laser Described for clinical use in DCR procedure was the KTP laser in 1993 by Reifler.then after Nd:YAG laser, Er:YAG laser and diode laser is used.among which diode laser is gaining popularity. Currently, this procedure is performed with an incision-free technique that avoids visible scarring, requires shorter operating time, produces less bleeding—and is easier to learn—than other DCR methods. **(Mor et al., 2018).**

Recently, minimally invasive techniques like transcanalicular laser-assisted endoscopic DCR have gained popularity. Currently, this procedure is performed with an incision-free technique that avoids visible scarring, requires shorter operating time, produces less bleeding, and is easier to learn than other DCR methods. Overall, the success rate of laser-assisted endoscopic DCR in relieving epiphora is reported to be between 60 and 90 percent.The procedure is usually performed in patients who are concerned about external scarring and want a minimally invasive procedure. Furthermore, it is advantageous for patients who have bleeding disorders or must remain on

anticoagulation medication. It is contraindicated in patients who have lacrimal or nasal sinus neoplasia. Relative contraindications include dacryolithiasis, canalicular obstruction, and canaliculitis. In addition, caution is needed in patients with altered nasal anatomy. Imaging studies are recommended to evaluate such patients to determine the nasal bony anatomy prior to surgery in selected cases. (**Woog et al., 2001**).

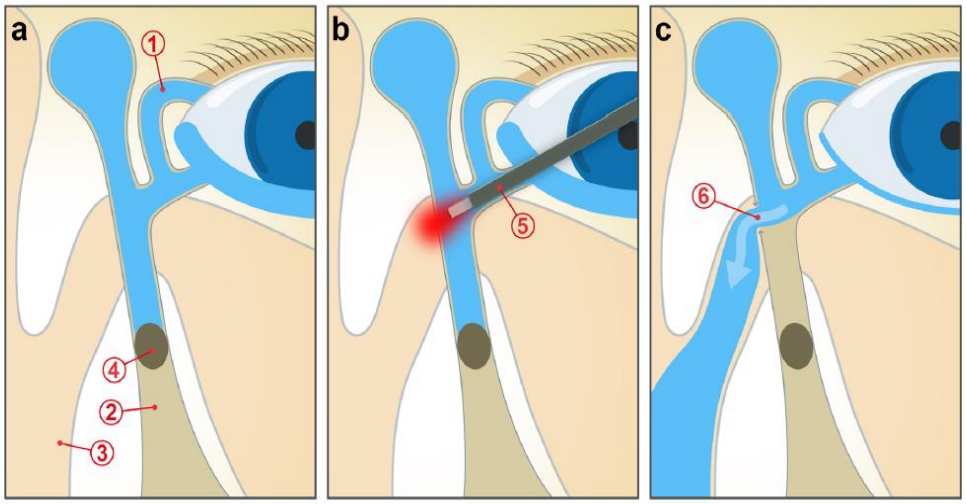

Fig. 1 Schematic display of primary acquired nasolacrimal duct obstruction treated by laser-assisted dacryocystorhinostomy. **a** An infrasaccal obstruction of the nasolacrimal duct leads to epiphora. The canaliculi are unobstructed. **b** A laser fiber is positioned in the lacrimal sac, aiming at the nasal wall to create a nasolacrimal bypass. **c** After the ostium has been created, tear flow is redirected through the newly formed ostium into the nasal cavity, bypassing the nasolacrimal duct obstruction

Advantages of trans-canalicular laser-assisted endoscopic DCR compared with conventional external DCR are minimal or no postoperative ecchymosis and edema, less surgical manipulation of medial canthal tissues and lacrimal pump, no scarring on the skin, minimal bleeding, and faster recovery time. In comparison with non-laser endoscopic techniques, trans-canalicular laser-assisted endoscopic DCR has the advantage of minimal bleeding and requires less complex endoscopic surgical skills. The decreased operative bleeding is particularly advantageous for elderly patients who must remain anticoagulated or for those have bleeding disorders (**Hong et al., 2005).**

A number of different lasers have been used to perform trans-canalicular endoscopic DCR including argon, Er: YAG, Nd: YAG, and diode laser. All of these lasers are delivered via a 400-600-µm semi-rigid fiberoptic probe.

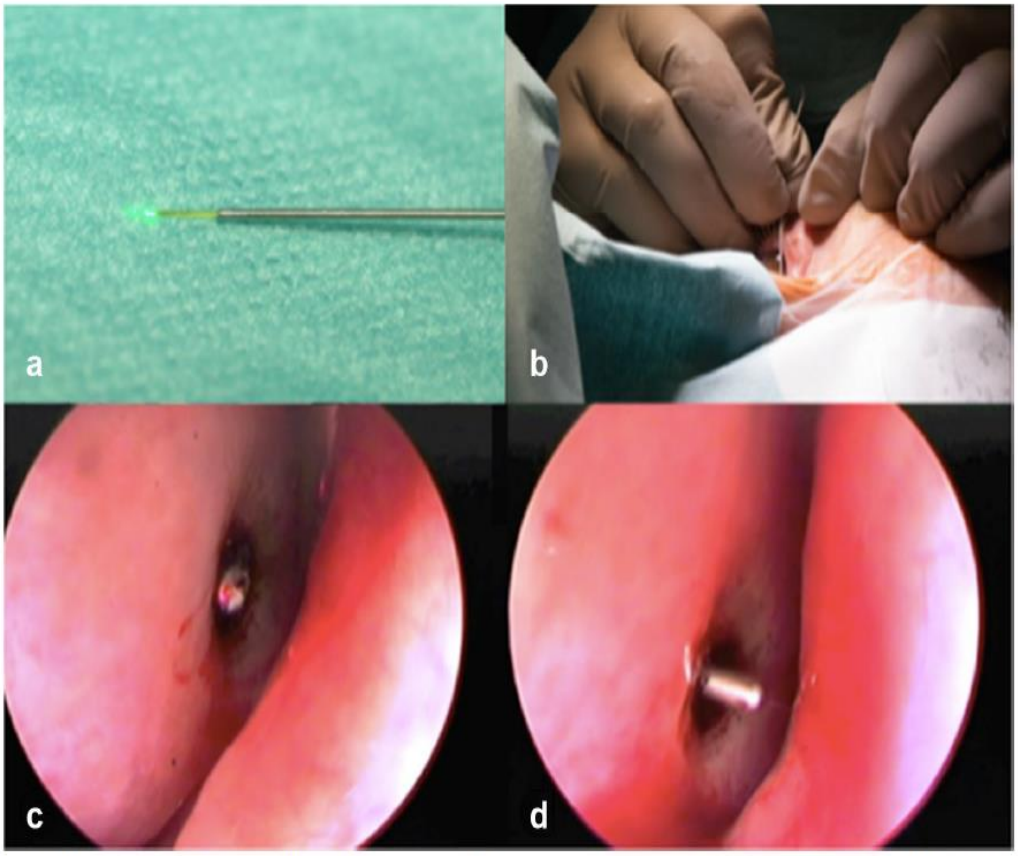

Fig. 2 Laser-assisted dacryocystorhinostomy. **a** Laser fiber (300 µm in diameter), connected to a 810-nm wavelength diode laser, fitted into a handpiece. **b** Correct positioning of the laser fiber with mediorostral orientation. **c** Transillumination shortly before the tip breaks through the nasal mucosa at the anteroinferior rim of the middle turbinate. **d** A blunt metal probe guiding a silicon tube is pushed through the ostium

Complications

DCR surgery requires a good understanding of the relationship between the lateral wall of the nose and the orbit, the skull base, and the maxillary sinus as each of which can be breached intraoperatively and an awareness of the regional vascular anatomy to prevent or manage haemorrhage (**Fayet et al., 2004**).

1.1. Penetrating the skull base

In external DCR, the medial canthus or medial canthal tendon can be used as a landmark with ostium formation generally not extending more than 3 mm above these structures. In endoscopic DCR if the mucosal flap and bony ostium are correctly located and the underlying lacrimal sac exposed, it is extremely unlikely that the skull base would be reached during ostium formation as it would require extensive removal of the thick frontal bone. However, the skull base can be breached by a spiral fracture extending through the frontal bone caused by excessive manipulation of the middle turbinate which inserts into the skull base or from aggressive twisting of rongeur during bone removal or by aggressive use of the Killian speculum on the nasal septum to increase the volume of the nasal cavity (**Fayet et al., 2007**).

1.2. Penetrating the orbit

The root of the vertical portion of the uncinate may be partially detached during endoscopic DCR exposing the anterior part of the lamina papyracea, which forms most of the medial wall of the orbit. This thin and fragile bone can be inadvertently removed with the lacrimal bone exposing periorbita, or orbital fat if the periorbita is breached. This does not usually have adverse consequences if the structures within the orbit are not traumatized (**Saul N et al., 2019**).

1.3. Penetrating the maxillary sinus

The maxillary sinus is located beneath the orbit, with its ostium in the middle meatus guarded by the uncinate. It is typically postero-inferior to the DCR bony ostium, but it can be inadvertently exposed at the inferior end of either a large or a misplaced ostium. There is no evidence that this complication has adverse consequences, although theoretically, the formation of an additional ostium may impact on sinus mucus circulation and drainage (**Saul N et al., 2019**).

1.4. Skin perforation

In contrast to external approach DCR surgery, while the anatomy of the internal aspect of the lateral wall of the nose is well visualized and understood, the proximity to the skin may not be as easily perceived. Orbicularis oculi muscle and skin lie on the lateral side of the lacrimal sac. These are usually not encountered in routine primary DCR, but in complex cases and particularly in redo-surgery and /or with the use of excessive diathermy or laser, these can be breached creating a skin fistula (**Yeniad et al., 2011).**

1.5. Bleeding

There are no ‘named’ neurovascular bundles in the area of nasal mucosal elevation, bony ostium formation, or lacrimal sac marsupialization. However, challenging bleeding can arise from small vessels, with the agger nasi being a common source. (**Saul N,et al, 2019**).

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