Original Article

Learning Curve in External DCR – A Trainee's Perspective

Karan Bhatia[1,2,3], Sabyasachi Sengupta[2], Madhu Bhadauria[1]
[1]Regional Institute of Ophthalmology, Sitapur Eye Hospital, Sitapur, Uttar Pradesh, India
[2]Aravind Eye Hospital and Postgraduate Institute of Ophthalmology, Pondicherry, India
[3]M. M. Joshi Eye Institute, Gokul Road, Hosur, Hubli, Karnataka, India

Abstract

Purpose: The aim of this study is to determine the success rate over time in patients undergoing External Dacryocystorhinostomy (DCR) with acquired naso-lacrimal duct obstruction (NLDO), when done by a trainee ophthalmologist. **Methods:** The study was Prospective Observational study and was conducted in Tertiary Eye Hospital, Uttar Pradesh, India. One hundred and fourteen consecutive adult patients underwent external DCR for acquired complete NLDO by a trainee with less than 3 years of experience in ophthalmology between November 2011 and March 2013. Postoperative anatomic success rate was determined at 6 months on the basis of the patency of lacrimal sac syringing and patients were asked to subjectively evaluate improvement of their epiphora using a questionnaire. **Results:** Anatomical success rate across the entire study period was 93.7% and this improved from 87% in the first tertile of 38 patients to 94% in the second tertile and 100% in the final tertile of cases ($p<0.05$). Overall complication rate was 16.67% and reduced from 29% in the first tertile to 8% in the final tertile ($p<0.05$). Loss of anterior nasal flap was the commonest complication (10 cases) during the training period. **Conclusion:** External DCR, as a primary procedure for acquired NLDO, even when operated by trainee ophthalmologists, has a relatively high success rate that improves over time. As the learning curve improves, complication rates reduce significantly. **Financial Disclosure:** No author has any financial or proprietary interest in the material or method mentioned.

Key words : Dacryocystorhinostomy, acquired nasolacrimal duct obstruction.

Introduction

Primary acquired nasolacrimal duct obstruction (NLDO) is responsible for more than 80% of NLDO in adults (Murthy et al, 2012). It occurs because of obstructions in the lower part of lacrimal passage and is seen three times more commonly in females, and predominantly affects the middle-aged and elderly. Other causes of NLDO include trauma, chronic sinus disease, tuberculosis, tumours etc. The clinical spectrum of NLDO ranges from epiphora to acute or chronic dacryocystitis. Chronic dacryocystitis is diagnosed by the presence of a painless swelling at the inner canthus, epiphora, a positive regurgitation on pressure over lacrimal sac (ROPLAS) and a delayed regurgitation of dirty fluid on lacrimal

Received: 30/01/17 Accepted: 26/06/17
Corresponding author
Dr. Karan Bhatia DOMS, DNB
Email – drkaranbhatia@gmail.com
Phone number - +91-8940565078

sac irrigation (Murthy et al, 2012; Wikipedia, 2016). External DCR remains the gold standard surgery for the treatment of acquired NLDO, since Totti described the first DCR operation in 1904 (Naik et al, 2010). This procedure creates an anastomosis between the lacrimal sac and the middle meatus of the nose, bypassing the nasolacrimal duct (Murthy et al, 2012). It is being practiced all around the world, with success rates ranging from 88% to 95% (Watts et al, 2001; Mirza et al, 2002; Besharati et al, 2005; Karim et al, 2011).

Various programs and models exist for the evaluation of cataract surgical training and there is extensive literature documenting the learning curve of phacoemulsification performed by trainee surgeons and residents (Randleman et al, 2007; Saleh et al, 2007; Rogers et al, 2009; ICO, 2016). Being an extraocular procedure, most trainees and residents begin their ophthalmic surgical training by performing DCR surgery. However, the learning curve for DCR performed by trainees is not well studied. Good results with DCR will give the trainee surgeon immense confidence to take on bigger challenges such as cataract surgery and other intraocular procedures. In view of this, there is a need to evaluate the learning curve in DCR. We performed a prospective study to document the learning curve in terms of success rates and complications in patients undergoing external DCR for acquired NLDO, when done by a trainee ophthalmologist.

Material and methods

This study was conducted from November 2011 to December 2013 at a tertiary level teaching eye hospital in northern India. All patients with complaints of epiphora diagnosed with acquired NLDO were invited to participate. Patients were provided with an information sheet translated into their language of preference (Hindi) and written informed consent was obtained from all participants. The study was approved by the institutional review board and was performed in accordance with the tenets of the Declaration of Helsinki.

The study enrolled patients between 18 and 70 years of age with complaints of epiphora, diagnosed as acquired NLDO by lacrimal sac syringing that revealed delayed regurgitation of dirty fluid from the opposite punctum. Only cases independently performed by a trainee surgeon (KB) were included in the analysis.

Patients with acute dacryocystitis, canalicular block diagnosed by immediate regurgitation of clear fluid from opposite/same punctum during syringing, nasal anomalies/ pathologies, mentally challenged individuals, history of facial trauma and failed previous DCR cases were excluded from the study.

All patients underwent pre-operative evaluation which included a detailed clinical history of watering, discharge, swelling, fistula, mucocoele, recurrent attacks of acute dacryocystitis, facial trauma, chronic environmental allergies, long standing sinus disease, use of eye drops, blood dyscriasis, drug allergy, hypertension, diabetes mellitus and any use of an anticoagulant. All patients underwent sac syringing and an ENT check up to rule out any nasal anomaly and pathology involving the middle meatus.

Routine blood investigations including haemoglobin, total leucocyte count, differential leucocyte count, bleeding time, clotting time, erythrocyte sedimentation rate and a random blood sugar were done in all patients.

After informed written consent, injection Diclofenac Sodium 75 mg intramuscular and injection Ethamsylate 250 mg intravenous were given 10 minutes before starting the procedure. Nasal packing was done with a gauze soaked in 2 % Lignocaine with 1:100000 adrenaline immediately before starting the procedure. Local anaesthesia with 2% Lignocaine and

1:100000 adrenaline was injected at the site of the planned incision subcutaneously (deep at the level of the periosteum). Initial few cases were done under supervision by a senior ophthalmologist (MB) experienced in external DCR surgery. The trainee (KB) was a first year ophthalmology resident without any prior experience with any ophthalmic surgical procedures.

A curved incision of 1-1.5 cm only as deep as the skin was given with a 15 # blade along the anterior lacrimal crest, about 3 mm medial to the medial canthus. Using curved scissors the muscle was dissected to the extent when the frontal process of maxilla was visible. The medial palpebral ligament was cut only if it interfered with the surgery. Using a Blunt dissector wrapped in cotton gauze, the muscle and periosteum were separated from the bone. The blunt dissector was passed in between the lacrimal sac and the lacrimal fossa, thus separating the sac all the way up till the lamina papyracea was exposed. This papery bone was broken with a periosteal elevator. Citelli's bone punch was passed in the space created and an ostium about 12 mm X 12 mm size was created. A Bowman's lacrimal probe was passed from the lower punctum and canaliculus, the lacrimal sac was identified and a vertical cut was made with a blade, through the anterior wall of the sac. Anterior and posterior lacrimal flaps were created with scissors and the posterior flap was removed to its full extent. A Bowman's lacrimal probe was passed through both the upper and lower punctum and canaliculi to confirm the patency. The nasal mucosa was incised horizontally twice with a blade at the two ends of the ostium. A muscle hook was passed underneath and the lower end was cut to make a flap. The anterior lacrimal flap and nasal flap were sutured with 6-0 vicryl. Orbicularis muscle was suture with 6-0 vicryl. The skin was then sutured with 6-0 mersilk in subcuticular or interrupted manner (Roper-Hall, 1989). All surgical complications were recorded in the clinical record form.

Postoperative treatment included systemic antibiotics for 7 days, tab. ethamsylate BD for 2 days, gatifloxacin eye drops QID and oxymetazoline nasal drops BD for 10 days. Skin sutures were removed between 8 - 10 days.

Data including results of lacrimal sac syringing performed by an observer, masked to the identity of the operating surgeon, were recorded on 1st day, 3rd day, 8-10 day, 3 weeks, 6 weeks, 3 months and 6 months after surgery. Additionally, the same masked observer administered a questionnaire to patients to subjectively evaluate the postoperative improvement of their epiphora at 6 months. The result of syringing at 6 months was considered to be the end point.

The primary outcome measure was the anatomical success rate at 6 months. Secondary outcome measure was the learning curve of the surgery and the associated complications.

The anatomical success rate was determined on the basis of the patency of lacrimal sac syringing at 6 month follow up. The patency of lacrimal sac syringing was graded as, I: Not patent, II: Partially Patent and III: Patent. Results reporting 'I' were defined as "failures" and 'II, III' as "anatomical success". In the questionnaire, patients were asked to quantify their symptoms as – A: No improvement, discharge and epiphora still persistent, B: No improvement, epiphora is the same or worse, C: Slight improvement, but epiphora still present, D: Significant improvement, but slight epiphora and E: Complete resolution of epiphora. Patients reporting as A, B, C were defined as "failures" and D, E as "functional success"

All data were tabulated in MS Excel and analysis was done using relevant statistical

tests. In order to study trends during the training period, surgical cases performed over time were arranged in chronological order divided into tertiles consisting of 38 cases each. Z test was used to analyse the surgical success rate across tertiles and Fischer's exact two tailed test was used to analyse the proportion of complications across the tertile of cases.

Results

One hundred and fourteen eyes underwent external DCR by a trainee ophthalmologist during the study period. The average age of participants was 35.7 years, 90 were females (79%) and the right eye was affected in 70 patients.

The overall anatomical success was seen 93.9 %. The lacrimal sac syringing was not patent in 7 patients (6.14%); was partially patent in 15 patients (13.16%) it, and in 92 patients (80.70%) it was patent. On the basis of the subjective questionnaire, 7 patients (6.14%) had no improvement with persistent discharge and epiphora, 14 patients (12.28%) had significant improvement with slight epiphora and 93 patients (81.58%) had complete resolution of epiphora. Thus, 107 patients (93.86%) experienced functional success.

Majority of failures occurred in the first tertile of 38 cases and there was a statistically significant improvement in success rates across tertiles with no failures in the final tertile (Table 1). Average duration of surgery was 1 hour and 15 minutes. Though surgical steps in the initial surgeries were influenced by the supervising surgeon, she did not dominate any of the surgeries entirely.

Overall complication rate was 16.67%. Table 2 shows tertile – wise distribution of complications. Loss of the anterior nasal flap was the commonest complication noted in 10 cases. There was a significant reduction in number of complications from the first to the last tertile of cases.

Table 1: Anatomic success rates across tertiles of cases performed by a trainee ophthalmologist.

Number of surgeries		Anatomic Success (n,%)	Difference in proportion (Z-value)	P-value
F	1-38	33 (86.84%)	1.31	> 0.05
M	39-76	36 (94.74%)		
M	39-76	36 (94.74%)	1.69	< 0.05
L	77-114	38 (100%)		
F	1-38	33 (86.84%)	2.39	< 0.01
L	77-114	38 (100%)		

F=First tertile, M=Middle tertile, L=Last tertile

Table 2: Comparison of Complication rates across tertiles.

Complications	Case Numbers			Total
	F:1-38	M:39-76	L:77-114	
Intraoperative				
Anterior nasal flap lost	5	3	2	10
Severe mucosal bleeding	2	2	1	5
Angular vein cut	2	0	0	2
Postoperative				
Suture Abscess	2	0	0	2
Total	11	5	3	19

P-values: E vs M - 0.01, M vs L - 0.71, E vs L - 0.04

Discussion

We found an acceptably low overall failure rate of 6% across more than 100 surgeries performed by a trainee ophthalmologist over a three year residency training period. The anatomical and functional success rate improved substantially such that there were no failures in the last set of 38 cases. Similar trends were seen in complication rates which reduced significantly from the initial period to acceptably low rates in the last tertile.

Extensive programs exist for cataract surgical training evaluation for trainee surgeons and residents (Randleman et al, 2007; Saleh et al, 2007; Rogers et al, 2009; ICO, 2016). But a parallel and robust program for evaluating

outcomes of DCR surgery is lacking. Pandya et al (2010) assessed 135 cases operated by different trainees and reported factors influencing the outcomes of external DCR. The trainees in this study had already finished their residency and presumably had some experience with DCR already. The authors concluded that in most cases, the trainee would have had significant assistance from the supervising consultant. Thus, the separation of their groups into cases done by consultants and trainees was artificial and did not reflect the reality of surgical practice. Malhotra et al (2015) reported the results of 38 cases of endonasal DCR independently performed by 3 trainee (all post – residency) oculoplasty surgeons, where all trainees underwent a supervised training and were allowed to operate independently only after a minimum of 6 months of fellowship training. They excluded the cases prior to being independent, thus excluding the learning curve. Kashkouli et al (2003) reported a retrospective case series of 276 external DCR being done mainly by trainee doctors but did not provide information on the learning curve i.e. success rates and complications over time. Mirza et al (2002) found an improved outcome in the last 38 cases of endonasal DCR out of a total of 76 cases but did not explicitly mention data documenting the learning curve. Surprisingly, no study till date has evaluated the learning curve in detail (Mirza et al, 2002; Pandya et al, 2010; Malhotra, 2015; Kashkouli et al, 2003). Ours was a unique study in which we compared the results of external DCR surgery by a trainee ophthalmologist over time. There was a need to not only study the success rate in budding young ophthalmic surgeons, but also document their learning curve and complications which they can experience especially during their initial surgeries. Hence, the surgeries of one surgeon with less than 3 years of experience in the field was taken.

The success rate achieved in our study was 93.86% after a follow up of 6 months. Majority of the complications and failures occurred in the first tertile of 38 cases. The numbers gradually reduced as the surgeon's experience grew. This indicates that this subset of 38 cases, was enough to learn the procedure to achieve acceptable results. Some intra-operative complications like the angular vein being severed, only happen when the surgeon is inexperienced. Others, like the loss of the anterior nasal flap and severe mucosal bleeding reduce with the growing skill and better tissue handling, which the surgeon learns over time.

Success rates previously reported by different authors are also similar. Karim et al (2011) performed external DCR on 100 patients and reported an anatomical surgical success rate of 91%, with a complication rate of 4.7%, after a follow-up of 6 months. However, only 81.6% of patients had symptomatic relief. Similarly, Watts et al (2001) reported a success rate of 94.7% in 19 patients at 12 months and Mirza et al (2002) reported a success rate of 94% in 49 patients after a mean follow-up of 9 months. All the surgeons in the above studies were highly experienced, with at least 10 years of experience in ophthalmology (Watts et al, 2001; Mirza et al, 2002; Besharati et al, 2005; Karim et al, 2011). In a study similar to ours, Besharati et al (2005) reported success rates of 88% in 149 patients in a teaching hospital in Iran, with a follow-up range of 3 months to 2 years. They did not report any intra-operative complications which is surprising, especially when the surgeries were done in a teaching hospital and presumably involved a few cases done by trainees.

To the best of our knowledge, there are no studies reporting on the surgical outcomes of external DCR surgery performed exclusively by a trainee. Hence, the learning curve of the surgery has never been documented. Not surprisingly, our study showed that as the surgeon's experience grew, the complication

and failure rates reduced. It also proved that even when surgery is performed at a learning stage, high success rates can be achieved.

One of strengths of our study was a relatively large sample. The study was limited by its short follow up, exclusion of canalicular block and failed surgical cases and results from a single trainee which may not be applicable to a larger set of trainees.

External DCR, as a primary procedure for acquired NLDO, even when done by trainee ophthalmologists, can be expected to have a high success rate. Surgical success and complication rates improve over time. Further studies are required to document the learning curve of external DCR and confirm our results, thereby establishing a minimum number of surgeries before which a trainee can be allowed to perform surgery independently.

References

Besharati, M, Rastegar, A (2005). Results and complications of external dacryocystorhinostomy surgery at a teaching hospital in Iran. Saudi Med J, 26(12): 1940-1944.

Karim, R, Ghabrial, R, Lynch, TF, Tang, B (2011). A comparison of external and endoscopic endonasal dacryocystorhinostomy for acquired nasolacrimal duct obstruction. Clinical Ophthalmology: 979.

Kashkouli, MB, Parvaresh, MM, Modarreszadeh, M, Hashemi, M, Beigi, B (2003). Factors affecting the success of external dacryocystorhinostomy. Orbit, 22(4): 247-255.

Malhotra, R, Norris, JH, Sagili, S, Al-Abbadi, Z, Avisar, I (2015). The Learning Curve in Endoscopic Dacryocystorhinostomy: Outcomes in Surgery Performed by Trainee Oculoplastic Surgeons. Orbit, 34(6): 314-319.

Mirza, S, Al-Barmani, A, Douglas, S, Bearn, M, Robson, A (2002). A retrospective comparison of endonasal KTP laser dacryocystorhinostomy versus external dacryocystorhinostomy. Clinical Otolaryngology and Allied Sciences, 27(5): 347-351.

Murthy, R, Menon, V, Gupta, A (2012). In Postgraduate Ophthalmology. New Delhi: Jaypee Brothers Medical Publishers, p. 1389-1399.

Naik, M, Honavar, S (2010). In Clinical Ophthalmology: Medical and Surgical Approach. 2nd ed. New Delhi: Jaypee Brothers Medical Publishers, p. 725.

Pandya VB, Lee S, Benger R, Kourt FG, Martin PA, Lertsumitkul, McCluskey P, Ghabrial R. (2010). External Dacryocystorhinostomy: Assessing Factors that Influence Outcome. Orbit, 29(5): 291-297.

Randleman JB, Wolfe JD, Woodward M, Lynn MJ, Cherwek, H, Srivastava SK (2007). The Resident Surgeon Phacoemulsification Learning Curve. Archives of Ophthalmology, 125(9): 1215.

Rogers, GM, Oetting, TA, Lee, AG, Grignon, C, Greenlee, E, Johnson, A, Beaver, H, Carter, K (2009). Impact of a structured surgical curriculum on ophthalmic resident cataract surgery complication rates. Journal of Cataract & Refractive Surgery; 35(11): 1956-1960.

Roper-Hall, MJ (1989). In Stallard's Eye Surgery; 8th ed. Mumbai: K. M. Varghese Company, p. 152-154.

Saleh, GM, Gauba V, Mitra A, Litwin AS, Chung AKK, Benjamin L (2007). Objective Structured Assessment of Cataract Surgical Skill. Archives of Ophthalmology; 125(3): 363.

Watts, P, Ram, A, Nair, R, Williams, H (2001). Comparison of dacryocystorhinostomy and 5-fluorouracil augmented endonasal laser dacryocystorhinostomy: A Retrospective

review. Indian Journal of Ophthalmology; 49(3): 169-172.

Wikepedia (2016). Dacryocystitis. [online] Available at: <https://en.wikipedia.org/wiki/Dacryocystitis> [Accessed 21 Aug. 2016].

Wikepedia (2016). International Council of Ophthalmology: Resources: Surgical Assessment Tool: ICO-OSCAR In English, Chinese, Portuguese, Russian, Spanish, Thai, Vietnamese, And French. [online] Available at: <http://www.icoph.org/resources/230/Surgical-Assessment-Tool-ICO-OSCAR-in-English-Chinese-Portuguese-Russian-Spanish-Vietnamese-and-French.html> [Accessed 4 Sep. 2016].