International Journal of Research in Medical Sciences
Jan S et al. Int J Res Med Sci. 2017 Dec;5(12):5197-5202
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20175130

Original Research Article

Evaluation of dacryocystorhinostomy failure with computed tomographic dacryocystography

Sabhia Jan[1], Apoorva[1], Junaid S. Wani[2], Raheel Riaz[2], Ovais Nazir[3]*

[1]Department of Ophthalmology, SHKM Government Medical College, Mewat, Haryana, India
[2]Department of Ophthalmology, Government Medical College, Srinagar, Jammu, India
[3]Department of Anaesthesiology, Lady Hardinge Medical College, New Delhi, India

Received: 26 October 2017
Accepted: 08 November 2017

***Correspondence:**
Dr. Ovais Nazir,
E-mail: ovais.khan83@gmail.com

ABSTRACT

Background: The purpose of this study is to evaluate the causes of failure of dacryocystorhinostomy by computed dacryocystography (CT-DCG).
Methods: CT-DCG was done in 38 patients of failed DCR of either sex in the age group of 16-60 years, the radiologist blinded to the clinical status of the patient evaluated position and size of bony ostium, soft tissue scarring, bony regrowth, secondary stenosis of canaliculi, synechiae between the ostium and nasal septum and anatomic variations in nasal cavity, turbinates or nasal septum.
Results: The most common causes of failure in our study were inappropriate size of osteotomy window in 34 patients (84.47%), inappropriate location of osteotomy window in 31 patients (81.57%), fibrous tissue scarring at osteotomy window in 22 patients (57.89%), the other causes were bilateral concha bullosa in 2 patients, ethmoidal sinusitis in 2 patients, common canalicular block in 1 patient, faulty passage into ethmoidal sinus in 1 patient and no osteotomy window seen in patient.
Conclusions: CT-DCG is a valuable imaging tool to evaluate DCR failure before re-operation. In our study CT-DCG showed that small size of osteotomy window, inappropriate position of osteotomy window and fibrous tissue scarring at osteotomy window were frequently seen causative factors of DCR failure.

Keywords: Computed tomographic dacryocystography, Computed tomography, Dacryocystorhinostomy

INTRODUCTION

Dacryocystorhinostomy is a surgical procedure which involves creation of an alternative route for drainage of tears between lacrimal sac and nasal cavity bypassing the nasolacrimal duct.[1]

Dacryocystorhinostomy can be performed either by external approach called external dacryocystorhinostomy or through the nasal cavity using an endoscope called endonasal dacryocystorhinostomy.[2]

The external DCR technique was originally described in 1904 by Toti and was subsequently modified in 1921 by Dupuy-Dutemps and Bourguet by the addition of suturing of the nasal and lacrimal mucosal flaps in order to form an epithelium-lined fistula.[3]

The endonasal approach was introduced in 1893 by Caldwell and later modified by West and Halle. The apparent advantages of endonasal DCR over external DCR are its less invasive nature, shorter operative time and preservation of pump function of the orbicularis oculi

muscle due to the absence of an external skin and orbicularis incision, absence of an external scar, minimal morbidity and less complication. The disadvantages of endonasal DCR include a relatively smaller opening between the lacrimal sac and nasal cavity, high equipment cost and a lower success rate than external DCR.[1]

The success rate of Endoscopic Dacryocystorhinostomy with laser assistance is between 58% and 85% whereas Endoscopic DCR procedures using other tools like drill, cold knife or punch yield slightly higher success rate.[4] External Dacryocystorhinostomy is a successful surgical procedure in about 90% cases. However, failure occurs in about 5-10% cases.[5]

Causes of failure of dacryocystorhinostomy

Dacryocystorhinostomy failure may result from the following causes

- Inappropriate size or location of osteotomy window,
- Scarring within rhinostomy.[6]
- Unrecognised common canalicular obstruction,
- Sump syndrome.[7]
- Chronic Rhinosinusitis,
- Intranasal synechiae.[8]
- Anatomic variants of nasal cavity or sinuses like anterior ethmoids,anterior middle turbinate or deviated nasal septum,
- Tumors involving lacrimal sac, nasal cavity or sinus.
- Inflammatory diseases like sarcoid or pseudotumor.[9]
- Faulty opening of the osteotomy into the anterior ethmoidal air cells or unrecognized concha bullosa,[10]

The most common cause of dacryocystorhinostomy failure is problem with the bony ostium, found in over half of the cases. Ideal bony ostium is the one which ensures that no bone is left within 5mm of the common canaliculus and that measures at least 15mm in diameter.[9]

Imaging techniques for evaluation of failed dacryocystorhinostomy

There are several imaging techniques for evaluating the causes of failed dacryocystorhinostomy including

- Conventional dacryocystography,
- Computed tomography,
- Nuclear scintigraphy.[11]
- Magnetic resonance dacryocystography,
- Computed tomographic dacryocystography.[11]

The aim of present study was to evaluate the causes of failure of dacryocystorhinostomy by computed tomographic dacryocystography and to obtain the information that may be useful in reoperation planning.

METHODS

This study was done in the Department of ophthalmology Government Medical College, Srinagar from May 2015 to Nov 2016. In this study we included 38 patients of either sex of age 16-60 years with failed Dacryocystorhinostomy operation. The study was carried after approval by the institutional ethics committee and informed written consent of the patients.

CT scan was performed on a 256 slice Siemens helical scanner. Before doing CT DCG, NCCT of PNS and orbits was done in all the patients. A 3mm thick helical axial sections were obtained from the level of hard palate to roof of orbit to look for bony canal, calcification or dacryolith.

CT-DCG was performed by administration of non- ionic water soluble iodinated contrast medium (300mg iodine/ml) in 1:1 dilution with distilled water. The procedure was performed by instillation of diluted contrast in the conjunctival cul de sac, 1-2 drops per minute per eye for 5 minutes followed by CT scanning. The drop method failed to demonstrate the lacrimal system adequately, so cannulation was done in three of our patients. Before cannulation topical 0.5% proparacaine was instilled and approximately 2ml of radiopaque contrast material was drawn into a syringe. The inferior punctum was dilated with a punctum dilator and 0.5-1ml of diluted contrast medium was injected slowly on each side using a 23G cannula. A 2mm thick helical sections were contained in an axial plane with a reconstruction interval of 1mm. The data acquired in the axial plane was reformatted into 3D and 2D coronal and oblique sagittal planes along the long axis of the lacrimal drainage apparatus.

The radiologist blinded to the clinal status of patients evaluated

- The position and location of bony ostium,
- Soft tissue scarring,
- Bony regrowth,
- Secondary stenosis of the canaliculi,
- Synechia between the ostium and nasal septum,
- Anatomic variations in the nasal cavity, turbinates or nasal septum.

Exclusion criteria

- Pregnant women,
- Patients who had known history of allergy to iodine,
- Patients who had acute dacryocystitis.

Examination method

Detailed history including history of previous lacrimal surgery was elicited and each subject underwent detailed ocular and lacrimal system examination which included

- Eyelid and puncta examination,
- Fluorescein dye disappearance test,
- Probing and syringing,
- Tear meniscus examination,
- Nasal examination-anterior rhinoscopy,
- Computed tomographic Dacryocystography.

The purpose of the study was as follows

- To evaluate the causes of failure of dacryocystorhinostomy by computed tomographic dacryocystography,
- To obtain the information that may be useful in reoperation planning.

Statistical analysis

Data was entered in Microsoft Excel spreadsheet and analysed using SPSS v 20. Descriptive statistics including means, standard deviation, minimum and maximum for continuous data and frequencies and percentages for categorical data were calculated.

RESULTS

In our study we had total 38 patients. The age range was 15 to 60 years. Thirty-five patients were females and 3 patients were males. Twenty-four patients had failed DCR in right eye and 14 patients had failed DCR in left eye. Single DCR surgery was done in 37 patients and one patient had undergone two DCR surgeries. External DCR was done in 36 patients and two patients had undergone Laser DCR.

In our study as shown in Table 1 it was seen inappropriate size (89.47%), inappropriate location (81.57%), and fibrous tissue scarring (57.89%) at osteotomy window were the common causes of DCR failure, respectively.

Table 1: Causes of failure.

Cause of failure	Number	%
Inappropriate size of osteotomy window	34	89.47
Inappropriate location of osteotomy window	31	81.57
Fibrous tissue scarring at osteotomy window	22	57.89
Bilateral concha bullosa	2	5.26
Ethmoid sinusitis	2	5.26
Common canalicular block	1	2.63
Faulty passage in ethmoid sinus	1	2.63
No osteotomy window	1	2.63

The antero-posterior diameter of the bony ostium ranged from 4mm to 15mm. we divided the patients into those with an antero-posterior diameter of bony ostium less than 15mm and those with a diameter equal to or more than 15mm, since 15mm was mentioned as a recommended diameter in the literature.[12] In 34 patients (89.47%) antero-posterior diameter of bony ostium was less than 15mm as shown below in table 2.

Table 2: Osteotomy window size.

Osteotomy size	Frequency	%
<15mm	34	89.47
≥15mm	3	7.89
Absent window	1	2.63

In our study out of 38 patients, the location of the osteotomy window was inappropriate in 31 patients (81.57%). Osteotomy window was located anterior to lacrimal sac in 28 patients (73.68%), inferior in 2 patients (5.26%), antero-superior in 1 patient (2.63%) as shown in table 3. In our study it was observed that out of 38 patients, 22 patients (57.89) had fibrous tissue scarring at osteotomy window as shown in table 3. In our study we also found bilateral concha bullosa in two patients as a cause of failure. We also found that out of the 38 patients two patients had ethmoidal sinusitis and one patient had faulty passage in ethmoid sinus.

Table 3: Osteotomy window location.

Osteotomy location	Frequency	%
Anterior	28	73.68
Normal	7	18.42
Inferior	2	5.26
Antero-superior	1	2.63

DISCUSSION

Dacryocystorhinostomy (DCR) is a surgical procedure which involves creation of an alternative route for drainage of tears between lacrimal sac and nasal cavity bypassing the nasolacrimal duct.[1] The failure of DCR is rare, occurring in less than 10% of cases in most of the series.[9] The management of unsuccessful DCR poses a therapeutic problem and Identifying the causes of failure may help the surgeon in planning the reoperation and makes it possible to exclude the causative factors before or during the operation. Several reasons of failure of DCR have been reported, including ostium problems such as small size and inappropriate position of osteotomy window, bone regrowth, variations in nasal cavity and paranasal sinuses (e.g., concha bullosa, ethmoidal bullae), lacrimal sac and canalicular problems, tumors, and inflammatory disease.[9,13,14,16-22]

In our study it was seen that out of the 38 patients, 34 patients (89.47%) had inappropriate size of osteotomy window. The antero-posterior diameter of the bony ostium ranged from 4mm to 15mm. We divided the patients into those with an antero-posterior diameter of bony ostium less than 15mm and those with a diameter equal to or more than 15mm, since 15mm was mentioned as a recommended diameter in the literature.[12] In 34

patients (89.47%) antero-posterior diameter of bony ostium was less than 15mm.

A Gokcek et al found in their study that out of eighteen patients, 17 patients (94%) had antero-posterior diameter of osteotomy window less than 15mm.[10] Herbert J. Glatt et al found in their study that out of five patients all of them reported problems with bony ostium and inappropriate size was found in one patient.[9] Jordan and McDonald reported that they attempted to avoid failure by creating a large ostium with an average diameter of 15 mm and removing enough bone between the medial wall of the lacrimal sac and the nose so that bone could not obstruct the passage.

For the success of external DCR, most of the authors believe that opening a large osteotomy window and eliminating all of the bone tissue within 5 mm distance from the common canaliculus is essential, as recommended by Jordan and McDonald.[12] In Welham and Wulc AE study of 208 patients, it was seen most of the DCR failures were related to ostium problems. Out of their 208 failed DCR cases, they found that 111 of them had inappropriate size or location of ostium.[13] However, McLachlan et al attributed few failures to the osteotomy in their review of unsuccessful DCRs. They also claimed that the size of surgical anastomosis does not correlate with surgical success.[15] Tarjani Vivek Dave et al also found that out of their 100 cases of failed DCR patients the most common cause of failure was inadequate osteotomy.[24] Linberg et al reported that the mucosal rhinostomy opening shrunk significantly in the postoperative period and there was no statistically valid correlation between the size of the bony opening and the final size of the healed intranasal ostium. In their series of 19 external DCRs the average diameter of bony ostium was 11.84 mm whereas the average diameter of the healed intranasal ostium was only 1.8mm.[25] Yazici and Yazici reported similar results.[26]

In this study we measured the A-P diameter of bony ostium on CT images and found that the proportion of cases with a bony ostium of less than 15 mm A-P diameter was significantly higher [(89.47%) antero-posterior diameter of bony ostium was less than 15mm]. The results of our study with regards to inappropriate size of osteotomy window as an important cause of DCR failure and are in accordance with the previous studies by Herbert J. Glatt, A Gokcek et al, Jordan and McDonald and Welham and Wulc.[9,10,12,13]

In our study out of 38 patients, the location of the osteotomy window was inappropriate in 31 patients (81.57%). Osteotomy window was located anterior to lacrimal sac in 28 patients (73.68%), inferior in 2 patients (5.26%), antero-superior in 1 patient (2.63%). Herbert J. Glatt et al found that out of their 5 unsuccessful DCR cases 3 patients had improper location of osteotomy window.[9] A. Gokcek et al reported that out of their 18 unsuccessful cases 15 patients (83%) had inappropriate location of osteotomy window.[10] In Welham and Wulc study it was seen out of their 208 failed DCR cases, they found that 111 of them had inappropriate size or location of ostium.[13] The results of our study with regards to inappropriate location of osteotomy window as an important cause of DCR failure are in accordance with the previous studies.

In our study it was observed that out of 38 patients, 22 patients (57.89) had fibrous tissue scarring at osteotomy window. Sarita Gonsalves et al found that the most common cause of failed external DCR in patients intraoperatively (who had persistence tearing and ROPLAS positive) was scarred ostium.[3] Welham and Wulc in their study found that out of 208 patients, 28 patients reported DCR failure due to scarring at osteotomy window. Of note is that, of the 15 cases that failed secondary surgery, 93% were thought to have failed because of exuberant scarring. One patient underwent unsuccessful surgery four times: no mucosa was available and on each occasion scar filled the anastomosis.

This patient required a bypass tube.[13] Mohd Ebrahim Yarmohammadi et al also found that out of their 50 failed DCR patients, 29 (58%) patients had osteotomy scarring as a cause of DCR failure.[28] Dr. Ramesh C Gupta et al also found that out of their 39 cases of failed DCR, the most common causes of failure was due to occurance of scarring within the anastomosis site.[29] Our study supports Sarita Gonsalves et al, Welham and Wul, Dr Ramesh C Gupta and Mohd Ebahimn Yar Mohammadi et al who reported osteotomy scarring as a cause of failure in significant number of their cases.[13,28,29]

A Gokcek et al also reported two patients out of their 18 patients with bilateral concha bullosa as a cause of DCR failure.[10] Elmorsy SM et al also found out of their 65 patients of failed external DCR 8 patients had choncha bullosa which contributed to cause of DCR failure.[31] Mohd Ebrahim Yar Mohammadi et al also found that out of their 50 failed DCR patients 22 (44%) patients had a concha bullosa which contributed to cause of DCR failure.[28] In our study we also found bilateral concha bullosa in two patients as a cause of failure and supports the Gokcek et al, Mohd Ebrahim Yar Mohammadi et al and Elmorsy SM et al in regards to choncha bullosa being a cause of DCR failure.[10,28,31]

We also found that out of the 38 patients two patients had ethmoidal sinusitis and one patient had faulty passage in ethmoid sinus. Gokcek et al also found that out of their 18 patients 3 patients had ethmoidal sinusistis which contributed to failure of DCR.[10] Elmorsy SM et al also found that out of their 65 patients of failed external DCR 6 patients had rhinosinusitis as a cause of DCR failure.[31]

The results of our study with regards to ethmoidal sinusitis as a cause of failure are in accordance with Gokcek et al and Elmorsy SM et al.[10,31]

We also found that one patient had common canalicular block which may contribute to preoperative misdiagnosis of nasolacrimal duct block and instead had a common canalicular obstruction. B. Pradhan also found that out of 7 patients postoperative recurrence of epiphora in 2 patients was due to upper lacrimal pathway obstruction.[8]

Radiologic investigation of the lacrimal system using CT-DCG has excellent capability of displaying both bone and soft tissues. It was developed in response to the preoperative imaging requirements for transnasal endoscopic dacryocystorhinostomy. However, it was also reported to be helpful in the assessment of patients after failed conventional external DCR wherein the information provided will help to determine the subsequent surgical approach.[23]

Mauriello et al investigated the role of orbital CT for evaluation of patients after dacryocystorhinostomy and concluded that when combined with the findings of probing and irrigation, orbital CT helped to formulate a surgical plan after failed DCR.[32] MR imaging is also a valuable technique for evaluation of the orbital cavity because of its superior demonstration capability of soft tissues. However, Manfre et al found that there was no significant difference between the sensitivities of MRDCG and CT-DCG in demonstrating nasolacrimal drainage system obstructions.[33] Helies et al compared MR-DCG with CTDCG in 13 patients with epiphora and concluded that CT-DCG must have been chosen for complex problems of the lacrimal drainage system. They claimed that only CT DCG helps to understand dacryocystorhinostomy failure very rare tumoral pathologies require MR imaging.[34]

We applied the radiopaque material topically into the conjunctival sac instead of catheterizing the lower canaliculus for it being simple and easy to perform. Topical contrast application is very easy to perform, allows a more physiologic evaluation of the nasolacrimal duct, and increases patient comfort and tolerance.

Gokcek et al also found that Spiral CT-DCG examination of failed DCR cases gives valuable information that may have an important role in planning the reoperation.[10] Salah Eldesoky et al also reported that CT-DCG is indispensable in the assessment of nasolacrimal duct obstruction.[30] Udhay P et al concluded that Helical CTDCG is a safe and useful diagnostic tool for the lacrimal surgeon.

In our study we preferred the spiral technique, which allows continuous imaging of lacrimal system and offers better image quality for coronal image reformats and three-dimensional reconstruction. Spiral CT-DCG findings of failed DCR patients gave information that helped us understand the failure and plan the reoperation. The study revealed that smaller size of the osteotomy window, inappropriate position of the osteotomy relative to the lacrimal sac, fibrous tissue scarring at osteotomy window were major contributors to the failure, besides the frequently detected additional abnormalities around the osteotomy, such as ethmoidal sinusitis, concha bullosa, and all of which might have a role in the failure of DCR.

CONCLUSION

CT-DCG is a valuable imaging tool to evaluate DCR failures before reoperation. In our study CT-DCG showed that small size of osteotomy window, inappropriate position of osteotomy window and fibrous tissue scarring at osteotomy window were frequently seen causative factors of DCR failure.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Gauba V. External versus endonasal dacryocystorhinostomy in a specialized lacrimal surgery center. Sau J Ophthalmol. 2014;28(1):36-9.
2. Simon GJ, Joseph J, Lee S, Schwarcz RM, McCann JD, Goldberg RA. External versus endoscopic dacryocystorhinostomy for acquired nasolacrimal duct obstruction in a tertiary referral center. Ophthalmol. 2005;112(8):1463-8.
3. Vivekanand U, Gonsalves S. Etiologies of Failed External Dacryocystorhinostomy-A Case Series. Indidan journal of applied research. 2014;4(3).
4. Jin HR, Yeon JY, Choi MY. Endoscopic dacryocystorhinostomy: creation of a large marsupialized lacrimal sac. J Kore Medic Sci. 2006;21(4):719-23..
5. Kim NJ, Kim JH, Hwang SW, Choung HK, Lee YJ, Khwarg SI. Lacrimal silicone intubation for anatomically successful but functionally failed external dacryocystorhinostomy. Kore J Ophthalmol. 2007;21(2):70-3.
6. Welham RA, Wulc AE. Management of unsuccessful lacrimal surgery. Brit J Ophthalmol. 1987;71(2):152-7.
7. Boboridis KG, Bunce C, Rose GE. Outcome of external dacryocystorhinostomy combined with membranectomy of a distal canalicular obstruction. Ame J ophthalmol. 2005;139(6):1051-5.
8. Pradham B. Outcome of Endoscopic DCR at TUTH. Nepalese J ENT Head Neck Surg. 2012;2(1):20-1.
9. Glatt HJ, Chan AC, Barrett L. Evaluation of dacryocystorhinostomy failure with computed tomography and computed tomographic dacryocystography. Ame J Ophthalmol. 1991;112(4):431-6.
10. Gokcek A, Argin MA, Altintas AK. Comparison of failed and successful dacryocystorhinostomy by using computed tomographic dacryocystography findings. Euro J Ophthalmol. 2005;15(5):523-9.

11. Udhay P, Noronha OV, Mohan RE. Helical computed tomographic dacryocystography and its role in the diagnosis and management of lacrimal drainage system blocks and medial canthal masses. Ind J Ophthalmol. 2008;56(1):31.
12. Jordan DR, McDonald H. Failed dacryocystorhinostomy: the sump syndrome. Ophthal Surg. 1993;24(10):692-3.
13. Welham RA, Wulc AE. Management of unsuccessful lacrimal surgery. Brit J Ophthalmol. 1987;71(2):152-7.
14. Dolman PJ. Comparison of external dacryocystorhinostomy with nonlaser endonasal dacryocystorhinostomy. Ophthalmol. 2003;110(1):78-84.
15. McLachlan DL, Shannon GM, Flanagan JC. Results of dacryocystorhinostomy: analysis of the reoperations. Ophthalmic surg. 1980;11(7):427-30.
16. Smith BC. Ophthalmic plast reconstructive surgery. St Louis CV Mosby. 1987;12:907-76.
17. Roper-Hall MJ. Stallard's Eye Surgery, 7th ed. London and Boston: Butterworth-Heinemann Medical. 1989;125-62.
18. Blaylock WK, Moore CA, Linberg JV. Anterior ethmoid anatomy facilitates dacryocystorhinostomy. Archives of ophthalmology. 1990;108(12):1774-7.
19. Welham RA, Henderson PH. Results of dacryocystorhinostomy analysis of causes for failure. Transactions of the ophthalmological societies of the United Kingdom. 1972;93:601-9.
20. Allen KM, Berlin AJ, Levine HL. Intranasal Endoscopie Analysis of Dacrocystorhinostomy Failure. Ophthalmic Plastic Reconstructive Surg. 1988;4(3):143-6.
21. Orcutt JC, Hillel A, Weymuller EA. Endoscopic repair of failed dacryocystorhinostomy. Ophthalmic Plast Reconstructr Surg. 1990;6:197-202.
22. Patrinely JR, Anderson RL. A review of lacrimal drainage surgery. Ophthalmic Plast Reconstructr Surg. 1986;2:97-109.
23. Waite DW, Whitted HB, Shun-Shin GA. Technical note: computed tomographic dacryocystography. Br J Radiol. 1993;6:711-4.
24. Dave TV, Mohammed FA, Ali MJ, Naik MN. Etiologic analysis of 100 anatomically failed dacryocystorhinostomies. Clinic Ophthalmol (Auckland, NZ). 2016;10:1419.
25. Linberg JV, Anderson RL, Bumsted RM, Barreras R. Study of intranasal ostium external dacryocystorhinostomy. Archives Ophthalmol. 1982;100(11):1758-62.
26. Yazici B, Yazici Z. Final nasolacrimal ostium after external dacryocystorhinostomy. Archives Ophthalmol. 2003;121(1):76-80.
27. Roper-Hall MJ. Stallard's Eye Surgery, 7th ed. London and Boston: Butterworth-Heinemann Medical. 1989;125-62.
28. Yarmohammadi ME, Ghasemi H, Jafari F, Izadi P, Nadoushan MJ, Chin NS. Teamwork endoscopic endonasal surgery in failed external dacryocystorhinostomy. J ophthal vision Res. 2016;11(3):282.
29. Kushwaha RN, Rastogi R, Gupta RC, Gupta P, Kumar S. Profile of ocular trauma in tertiary care centre. Journal of Evolution of Medical and Dental Sciences. 2013;2(27):4903-15.
30. Eldesoky S, Farouk H, Moustafa AN, El-noueam K, Elsabaa A. The role of multi-detector CT dacryocystography in the assessment of naso-lacrimal duct obstruction. Egy J Radiol Nuclear Medic. 2012;43(3):397-405.
31. Elmorsy SM, Fayk HM. Nasal endoscopic assessment of failure after external dacryocystorhinostomy. Orbit. 2010;29(4):197-201.
32. Mauriello Jr JA, Vahedra V, Fleckner M, Shah C. Correlation of orbital computed tomographic findings with office probing and irrigation in 17 patients after successful and failed dacryocystorhinostomy. Ophthalmic Plastic Reconstructive Surg. 1999;15(2):116-20.
33. Manfrè L, de Maria M, Todaro E, Mangiameli A, Ponte F, Lagalla R. MR dacryocystography: comparison with dacryocystography and CT dacryocystography. Ame J Neuroradiol. 2000;21(6):1145-50.
34. Helies P, Cosnard G, Pharaboz C, Maille M, Maurin JF. Dacryocystography using CT and MRI. Comparative study apropos of 13 clinical cases. J Fr Ophtalmol. 1995;18:763-70.

Cite this article as: Jan S, Apoorva, Wani JS, Riaz R, Nazir O. Evaluation of dacryocystorhinostomy failure with computed tomographic dacryocystography. Int J Res Med Sci 2017;5: 5197-202.