Original Article/นิพนธ์ต้นฉบับ

Anterior Flap Anastomosis Alone with Silicone Intubation for Successful External Dacryocystorhinostomy in Primary Acquired Nasolacrimal Duct Obstruction

Jutarat Pomsathit, M.D.

Abstract

Objective: To evaluate the outcomes of external dacryocystorhinostomy (DCR) by only anterior flap anastomosis with silicone intubation.

Study design: Prospective consecutive case series

Methods: A total of ninety two eyes (eighty four patients) with primary acquired nasolacrimal duct obstruction were enrolled in the study. A presenting age of 62.2+/-10.2 years (range, 44-89 years) underwent external DCR from January 2013 to December 2013 in Department of Ophthalmology, Chaopraya Yommarach Hospital Suphanburi. All ninety two eyes underwent external DCR with U-shaped nasal mucosal flap and only anterior flap anastomosis. Silicone tube was placed for one month. The success rate was determined based on the patency of lacrimal system by irrigation and resolution of patient symptoms up to 6 months.

Results: The external DCR with only anterior flap anastomosis with silicone intubation for one month had a success rate of 97.83% (90/92 eyes). The average duration of surgery was 44.0 minutes. No adverse effect (eg. abnormal nasal bleeding, secondary infection, increase intraocular pressure) or any other surgical adverse events were observed. The patients almost satisfy of unremarkable cutaneous scar.

Conclusion: Creating only the anterior anastomosis with silicone intubation is technically simpler than traditional double flap anastomosis with a good surgical outcome. The silicone intubation for one month augmented the successful external DCR without any adverse effect. **Thai J Ophthalmol 2014; January-June 28(1): 1-9.**

Keyword: nasolacrimal duct obstruction, external dacryocystorhinostomy, anterior anastomosis, silicone intubation

No Author has a financial or proprietary interest in material or method mentioned

Department of Ophthalmology, Chaopraya Yommarach Hospital, Suphanburi

Original Article/นิพนธ์ต้นฉบับ

ผลการรักษาผู้ป่วยโรคท่อน้ำตาอุดตันโดยวิธี external dacryocystorhinostomy โดยใช้เทคนิคเย็บเฉพาะ anterior flap ร่วมกับการใส่ท่อ silicone tube

จุฑารัตน์ ป้อมสถิตย์ พ.บ.

บทคัดย่อ

จุดประสงค์: เพื่อประเมินผลการผ่าตัดรักษาผู้ป่วยโรคท่อน้ำตาอุดตัน โดยวิธี external dacryocystorhinostomy โดยใช้เทคนิคเย็บเฉพาะ anterior flap ร่วมกับการใส่ท่อ silicone tube

รูปแบบการศึกษา: Prospective consecutive case series

วิธีการศึกษา: ผู้ป่วยที่ได้รับการวินิจฉัยโรคท่อน้ำตาอุดตันชนิดปฐมภูมิ ที่หน่วยตรวจผู้ป่วยโรคตา แผนกจักษุวิทยา โรงพยาบาลเจ้าพระยายมราช จังหวัดสุพรรณบุรี จำนวน 92 ตา (84 คน) โดยพบว่ามีอายุเฉลี่ย 62.2 ± 10.2 ปี (44-89 ปี) ได้รับการผ่าตัดรักษาโรคท่อน้ำตาอุดตันในช่วงระหว่าง เดือน มกราคม ปี 2556 ถึง เดือนธันวาคม ปี 2556 โดยวิธี external dacryocystorhinostomy และใช้เทคนิคเปิด mucosal flap เป็นรูป u-shaped เย็บเฉพาะ anterior flap ร่วมกับการใส่ท่อ silicone tube เป็นระยะเวลาหนึ่งเดือน โดยวัดผลสำเร็จของการผ่าตัด ด้วยการประเมินจากการล้างท่อน้ำตา และอาการของผู้ป่วย ที่ระยะเวลาหลังผ่าตัด 6 เดือน

ผลการศึกษา: การผ่าตัดรักษาผู้ป่วยโรคท่อน้ำตาอุดตัน โดยวิธี external dacryocystorhinostomy โดยใช้เทคนิคเย็บเฉพาะ anterior flap ร่วมกับการใส่ท่อ silicone tube เป็นระยะเวลา 1 เดือน พบว่าได้ผลสำเร็จ สามารถล้างท่อน้ำตาได้ลงคอดีที่ระยะเวลา 6 เดือน หลังผ่าตัด ร้อยละ 97.83 (90/92 ตา) ใช้เวลาในการผ่าตัดเฉลี่ย 44 นาที ไม่พบอาการแทรกซ้อน เช่น เลือดออกผิดปกติทางแผลหรือจมูก, การติดเชื้อแทรกซ้อน, ภาวะความดันตาขึ้นสูง เป็นต้น ผู้ป่วยส่วนใหญ่พึงพอใจกับแผลผ่าตัดที่ไม่เป็นแผลเป็นที่เด่นชัด

ผลสรุป: เทคนิคการผ่าตัด external dacryocystorhinostomy โดยใช้เทคนิคเย็บเฉพาะ anterior flap เป็นเทคนิคที่ง่ายและประหยัดเวลาในการผ่าตัด โดยยังได้ผลสำเร็จในการผ่าตัดดีเทียบเคียงกับวิธีเดิมที่เย็บ double flap และ การใส่ท่อ silicone tube เป็นระยะเวลา 1 เดือน อาจช่วยเพิ่มผลความสำเร็จในการผ่าตัดรักษาโรคท่อน้ำตาอุดตันได้อีกด้วย **จักษุเวชสาร 2014; มกราคม-มิถุนายน 28(1): 1-9.**

ผู้นิพนธ์ทั้งหมดไม่มีส่วนเกี่ยวข้องหรือผลประโยชน์ใดๆ กับผลิตภัณฑ์ที่ได้กล่าวอ้างถึงในงานวิจัยนี้

กลุ่มงานจักษุวิทยาโรงพยาบาลเจ้าพระยายมราช สุพรรณบุรี

Introduction

Primary acquired nasolacrimal duct obstruction is the most common form of nasolacrimal duct obstruction and causes epiphora. The evolution of surgical therapy for lacrimal obstruction dates back to 1893 when Caldwell described an intranasal dacryocystorhinostomy (DCR) performed via trephination of the nasolacrimal duct.[1] Almost a century ago in 1904, a French ophthalmologist Adeo Toti, introduced the external DCR using skin sutures alone for wound closure after resection of the lacrimal sac, nasal mucosa and intervening bone.[2] In 1921, Dupuy-Dutemps and Bourguet modified Toti's procedure by direct suturing of the cut edges of nasal and lacrimal sac mucosal flaps with improved rates of successful epithelium-lined fistulization.[3] This technique has remained the gold standard in the treatment of acquired nasolacrimal duct obstruction.[4] Suturing the anterior and posterior flaps of the nasal mucosa with the lacrimal sac was suggested by Ohm.[5] Routine use of silicone tube intubations as a useful adjunct to external DCR procedure was advocated by Older.[6] External DCR is the most popular operation done for nasolacrimal duct obstruction and the gold standard by which other methods can be measured and compared.[7-9] The objectives of this study were to determine the success rate and to determine the intra and postoperative complications of this technique for treating primary acquired nasolacrimal duct obstruction by anterior flap anastomosis alone with silicone intubation external DCR.

Materials and Methods

A prospective study was conducted in 84 patients, 92 eyes, all of whom had primary acquired nasolacrimal sac or duct obstruction underwent external DCR from January 2013 to December 2013 at Department of Ophthalmology, Chaopraya Yommarach Hospital Suphanburi. All patients were assessed by complete ophthalmic examinations. There were more female patients 83 (90.2%). Range of age group was 44-89 years, mean age was 62-2 years (Table 1).

Preoperative assessment included syringing and probing. The lids were inspected, focusing on the positions of the lacrimal puncta and the function of orbicularis muscle. Finger palpation of the lacrimal fossa of the enlarged lacrimal sac is essential. Mucoid or mucopurulent reflux on gentle pressure on the lacrimal sac establishes the diagnosis of dacryocystitis. Only patients with primary acquired nasolacrimal sac or duct obstruction were included to this study. Exclusion criteria were canalicular obstruction ascertained with probing, noticeable lower lid laxity, previous lacrimal surgery, age younger than 15 years, suspicion of malignancy, radiation therapy, posttraumatic bony deformity and bone diseases and antiplatelets user who could not suspend treatment before surgery at least 7 days.

All operations were performed between November 2011 and July 2013. The external DCR operations were performed with the patient under general anesthesia. Gauze strips in ephedrine were applied intranasally between the posterior part of the middle and lower turbinate, as well as the roof of the nasal cavity, to achieve a good hemostasis. An incision of approximately 0.8-1.2 cm. in length was made medial to the angular vein, starting at the level of the medial canthal tendon. The orbicularis muscle fibers were separated with blunt dissection. The periosteum overlying and medial to the anterior lacrimal crest was exposed. The periosteum incision was made just medial and inferior to the bony insertion of the medial canthal tendon. The osteotomy, approximately at least 10 mm. in diameter, was created with Kerrison rongeurs. The nasal mucosa were opened to form

Table 1. Characteristic of patients

Characteristic	Total
Total No. of patients /Operations	84 / 92
Age (year)	
Mean ± SD	62.2 ± 10.2
Range	44 - 89
Sex	
Male / Female	9 / 83
Duration of symptoms (month)	
Mean	22.4
Range	1 - 240
Laterality of surgery (right / left)	43 / 49

an anterior U shaped flap, the shorter posterior flaps were left without suture. The lacrimal sac mucosa was inspected. The site of nasolacrimal obstruction was localized by probing, and the internal punctum was inspected as well. Bleeding was checked and stopped by bipolar electrocautery or occasionally by use of surgicell when massive bleeding occurred. The silicone tube was inserted and tied with several knots. The 6-0 Vicryl sutures were used to join the two flaps. One suspended suture of two flaps of the periostium was performed, to elevate them anteriorly in order to avoid adhesions with underlying tissue, and to approximate the deep planes of wound. The skin incision was closed with 6-0 silk sutures. Nasal packing was performed in some cases which blood oozing still occurred after completing the DCR procedure. The operative time was measured from starting the ephedrine soaked gauze nasal packing to the end of the application of the pressure bandage. Postoperative care consisted of frequent cold compression, head elevation, topical dexamethasone 4 times a day, Steroid nasal spray twice a day for one month, and systemic antibiotics only in cases that had flank pus in the operative field.

At the first follow up visit 1 week after surgery, the suture stitches were removed and the lacrimal passage was irrigated with saline solution. At one month after surgery, the silicone tube was removed and the lacrimal passage was irrigated. The tube was removed by cutting the silicone tube between the puncta and by either blowing the nose or by extracting the tube from the nose with forceps. The next follow up visit was at 6 months after surgery. The surgical outcome was considered successful if the saline solution freely reached the nose during the lacrimal sac irrigation and if the patients had no tearing, or recurrent conjunctival discharge. Patients were asked about their satisfaction with the cosmetics of the cutaneous scar.

Results

The operation was classified as successful by the objective demonstration of a patent nasolacrimal system through irrigation. The success rate at 6 months after surgery was 90 in 92 eyes (97.83%). (Table 2)

The average duration of surgery was 44.0 minutes. Complications during surgery seldom occurred;

Table 2. Patency rates at scheduled postoperative follow-up visits

	Postoperative Follow-up Visit	
1 week	0 (failed irrigation)	1 (1.09 %)
	1 (partial patency)	13 (14.13 %)
	2 (full patency)	78 (84.78 %)
1 month	0 (failed irrigation)	2 (2.17 %)
	1 (partial patency)	1 (1.09 %)
	2 (full patency)	89 (96.74 %)
6 months	0 (failed irrigation)	2 (2.17 %)
	1 (partial patency)	0 (0)
	2 (full patency)	90 (97.83 %)

Table 3. Intraoperative details

Intraoperative Details	
Intraoperative Time (minute)	
Mean	44.0
Range	20 - 65
± SD	± 16.2
Intraoperative Packing (Eye)	1

there was only one copious intraoperative hemorrhage. She needed intraoperative intranasal packing. She was discharged from the hospital in the next two days and there was no more postoperative hemorrhage after that. (Table 3)

Postoperative delayed intranasal bleeding occurred in three cases. None of them had copious intraoperative bleeding. Operation times were 50, 25 and 55 minutes. The duration of delayed bleeding was 8, 7 and 6 days. (mean 7 days)

Mean postoperative intraocular pressure at the first week visit was 12.70 mmHg. At the first month visit it was 13.26 mmHg. Three cases had transient increase in intraocular pressure at the first month visit .The pressures were 22.7, 22.5 and 22.2 mmHg. All of these patients were evaluated by gonioscopy, and open angles were found. The intraocular pressures returned to normal level after ceasing topical dexamethasone in all cases. All of them had surgical success. The patient's satisfaction about the cutaneous scar was evaluated at the 6 month follow up visit, with mean 8.7±0.9 by Numeric Rating Scale (NRS; 0 = unsatisfied patient, 10 = satisfied patient).

Discussion

Technically, the external DCR technique of Dupuy-Dutumps and Bourguet, in which the anterior flaps and the posterior flaps are sutured to achieve a controlled epithelium-lined anastomosis, was used in this study.[10-16] The advantage of external DCR is good intraoperative visibility inside the lacrimal sac, allowing inspection of the internal punctum and lacrimal sac mucosa and permitting biopsies to be performed easily. Dacryoliths could be detected and

also removed. The good exposure and visualization allowed creation of large bony ostium and easily to stop intraoperative bleeding. The external DCR with various modifications consistently has yielded success rates of approximately 90-100%.[13-16]

Though the suturing of the anterior and posterior mucosal flaps increases the probability of primary healing of the mucosal anastomosis and reduces the tendency to primary and secondary hemorrhages as pointed out by Jones and Welham,[17-18] we have found it simpler in lacrimal surgery to use anterior suspended flaps only. Many reports found the anastomosis of posterior flaps does not seem to affect the success rate of external DCR. Creating only the anterior anastomosis is technically simpler and does not seem to negatively influence the outcome of DCR surgery.

Yazici B and Yazici Z,[19] who used digital subtraction macrodacryocystography to evaluate the nasolacrimal ostium 6 months after successful external DCR, they found that the lacrimal sac reforms after surgery, and the final ostium develops at the inferior part of the regenerated sac, which confirms the irrelevance to final ostium size of suturing the posterior and anterior flaps. Recently, one meta-analysis identified and analyzed seven studies. Overall, DCR with anterior and posterior flap anastomosis was performed on 368 eyes, while primary external DCR with anterior flap anastomosis was performed on 397 eyes. There was no significant difference in the success rates of both techniques. (risk ratio: 0.987; 95% confidence interval 0.946-1.030)[20]

Despite meticulous surgery, failures are often found. The two most common causes of DCR failure are common canalicular obstruction and obstruction at the rhinostomy site. McPherson and Egleston noted that 3 out of 7 patients in their study who underwent a second operation were found to have a dense scar

Table 4. Postoperative complications

Postoperative Complication	
Pain score postoperative	2 - 5
Range	
(0 = no pain)	
(10 = intractable pain)	
Mean ± SD	4 ± 0.7
Delayed Bleeding(Eye)	
no bleeding	89
present bleeding	3
Mean Postoperative (IOP, mmHg)	
1 week	12.70
1 month	13.26
Cutaneous scar complaint	
Range	8 - 10
(0 = unsatisfied patient)	
(10 = satisfied patient)	
Mean ± SD	8.7 ± 0.9

tissue present at rhinostomy site.[21] To prevent post DCR obstruction, a technique of inserting a silicone rubber was described by Gibbs in 1967.[22] Most importantly, the insertion of a silicone tube into the lacrimal drainage system during DCR may prevent postoperative obstructions by securing an open pathway during the healing process. Moreover, surgical cases involving either excessive bleeding or inadvertent nasal mucosal tears are more easily completed in the presence of a tube. In addition, a silicone tube lifts the flaps anteriorly into a position that reduces the technical demands of suturing, which is most appreciated in cases with decreased visibility due to excessive bleeding, and a tube can also act as a support structure for torn anterior flaps and maintain patent drainage passage in cases that would otherwise require very difficult near impossible suturing.

DCR with silicone tube intubation has been accepted as a highly successful procedure in patients with a history of epiphora and discharge following chronic dacryocystitis. A review of the literature reveals a success rate of 90-95%. [23-25] The duration the tube is left in place varies depending on surgeon preference, from several weeks up to more than 12 months. The time frame for silicone tube removal varied in the literature from as early as 3 to 7 weeks to as late as over a year.[26-32] Pandya et al, in a retrospective study, reviewed 338 external DCR surgeries and found that silicone intubation for longer than 6 months increased the success rate of the procedure.[33] Charalampidou et al. reviewed a retrospective study of external DCR and found that out of 180 cases, 94 tubes were removed between 2 to 4 months, 24 tubes were removed before the planned 2 month period and 62 tubes were removed after the 4 month period. This study suggests that timing between two and four month of silicone tube removal does not influence surgical success in external DCR regardless of the cause of early or late tube removal.[34] A survey of ophthalmologists also found out that the tubes were removed as early as 4 weeks. Importantly, duration of silicone tube intubation and granulation tissue formation are known to be important factors for surgical failure in DCR. Prolonged intubation has been shown to associate with higher failure rate because of granulation reaction induced at ostium.[35] Our study found that only one month for silicone removal contributed to the success rate in anterior flap anastomosis external DCR without granulation tissue formation or any complication.

In this study, the success rate was defined by an anatomically patent nasolacrimal system ascertained by irrigation at 6 months after surgery. Our success rate is 97.83%, it showed a similar tendency to previous reported success rates: 98.33% reported by Zaman et al[36], 89.41% reported by Turkcu[37]et al and 96.67% reported by Serin.[38] Anastomosis of only the anterior flap is not disadvantageous to the outcomes of external DCR surgery when compared with the more traditional approach of anastomosis of both flaps. Silicone intubation for one month can augment the success rate without serious complication.

The perceived disadvantages of the highly successful external DCR include the risk of cutaneous scar and lengthy surgery with significant blood loss.[39-42] A Previous study reported the cutaneous scar from external DCR rarely causes serious cosmetic problems, especially if the incision respects relaxed skin tension lines.[43] Our study also shows that the patients accepted the cosmetic cutaneous scar with a high score (mean 8.7±0.9) for patient's satisfactory at the six months follow up visit. The mean surgical time for our modification technique was 44.0±16.2 min. not different from 41.1±10.3 min.

reported by Malhotra et al with no difference with endonasal endoscopic DCR (39.6±13.8 min.).[44] No massive bleeding was observed in our study.

Conclusion

Creating only the anterior anastomosis with silicone intubation is technically simpler than traditional double flap anastomosis with a good surgical outcome. The silicone intubation for one month augmented the successful external DCR without any adverse effect.

References

1. Caldwell GW. Two new operations for obstruction of the nasal duct, with preservation of the canaliculi, and with an incidental description of a new lacrimal probe. Am J Ophthalmol 1893;10:189-93.
2. Toti A. Nuovo metodo conservative di cura radicalle delle supporazioni cronicle del sacco lacrimale. Clin Mod Firenze 1904;10:385-7.
3. Dupuy-Dutemps L, Bourguet M. Procede plastique de dacryocystorhinostomie. Ann Ocul 1920;158:241-61.
4. Hughes SM .The history of lacrimal surgery. Ophthalmic Plast Reconstr Surg 1986;(5):139-68.
5. Ohm J Bericht Über 70 totischeoperazionen. Z Augenheilkd 1921;46:37-45.
6. Older JJ. Routine use of a silicone stent in a dacryocystorhinostomy. Ophthalmic Surgery 1982;13:911-5.
7. Seppa H, Grenman R, Hartikainen J. Endonasal Co2-Nd: YAG laser dacryocystorhinostomy. Acta-ophthalmol Copenh 1994; 72(6):703-6.
8. Cokkeser Y, Evereklioglu C, Er H. Comparative External Versus Endoscopic Dacryocystorhinostomy: Results in 115 Patients (130 Eyes). Otolaryngol Head Neck Surg 2000; 123: 488-91.
9. Karim R, Ghabrial R, Lynch T, Tang B. A comparison of external and endoscopic endonasal dacryocystorhinostomy for acquired nasolacrimal duct obstruction. ClinOphthalmol 2011; (5):979-89.
10. Ezra E, Restori M, Mannor GE, Rose GE. Ultrasonic assessment of rhinostomy size following external dacryocystorhinostomy. Br J Ophthalmol 1998;82:786-9.
11. WelhamRA, Wulc AE. Management of unsuccessful lacrimal surgery. Br J Ophthalmol 1987;71:152-7.
12. Hurwitz JJ. Dacryocystorhinostomy. In:HurwitzJJed.The Lacrimal System. Philadelphia, Pa Lippincott-Raven Publishers 1996;261-96.
13. Jordan DR. Standard external dacryocystorhinostomy. In:MaurielloJAed.Unfavorable Results of Eyelid and Lacrimal Surgery Boston, Mass Butterworth-Heinemann 2000;519-30.
14. Werb A.Surgery of the lacrimal sac and nasolacrimal duct. In:MilderBWeilBAeds.The Lacrimal System Norwalk, Conn Appleton-Century-Crofts 1983;153-63.
15. Wilkins RB, Berris CE, Dryden RM, Doxanas MT, McCord CD. Lacrimal drainage system disorders. In:McCordCD TanenbaumMeds. Oculoplastic Surgery. New York, NY Raven Press 1987;377-405.
16. Fayers T, Laverde T, Tay E, Olver JM. Lacrimal surgery success after external dacryocystorhinostomy: functional and anatomical results using strict outcome criteria. Ophthal Plast Reconstr Surg 2009;25(6):472-5.
17. Jones BR.Principles of lacrimal surgery. Trans Opthalmol Soc UK 1973;93:611-18.
18. Welham RAN, WulcAE. Management of unsuccessful lacrimal surgery. Br J Ophthalmol 1987;71:152-7.
19. Yazici B, Yazici Z. Final nasolacrimal ostium after external dacryocystorhinostomy. Arch Ophthalmol 2003;121:76-80.
20. Amal A Bukhari. Meta-analysis of the effect of posterior mucosal flap anastomosis in primary external dacryocystorhinostomy. Clinical Ophthalmology 2013;7:2281-5.
21. McPherson SD, Egleston D. Dacryocystorhinostomy: a review of 106 operations. Am J Ophthalmol 1959;47:328-31.
22. Gibbs DC. New probe for the intubation of lacrimal canaliculi with silicone rubber tubing. Br J Ophthalmol 1967;51:198.
23. Tarbet KJ, Custer PL. External Dacryocystorhinostomy: surgical causes, patient satisfaction and economic cost. Ophthalmology 1995;102:1065-67.
24. Wallant MJ, Rose JE. Factors affecting the success rate of open lacrimal surgery. Br J Ophthalmol 1994;78:888-91.
25. Becker BB. Dacryocystorhinostomy without flaps. Ophthalmic Surg 1988;19:419-27.
26. Onerci M. Diagnosis and treatment of nasolacrimal canal obstructions. Rhinology 2002;40(2):49-65.
27. Wormald PJ. Powered endoscopic dacryocystorhinostomy. Laryngoscope 2002;112(1):69-71.
28. Saiju R, Morse LJ, Weinberg D, Shrestha MK, Ruit S. Prospective randomized comparison of external Dacryocystorhi-

nostomy with and without silicone intubation. Br J Opthalmol 2009;93(9.):1220-2.

29. Gauba V. The practice of dacryocystorhinostomy (DCR) surgery by ophthalmologists in the United Kingdom (UK). Orbit 2008;27(4):279-83.
30. Nemet AY, Fung A, Martin PA, Benger R, Kourt G, Danks JJ et al. Lacrimal drainage obstruction and dacryocystorhinostomy in children. Eye 2008;22(7):918-24.
31. Kashkouli MB, Parvaresh M, Modarreszadeh M, Hashemi M, Beigi B. Factors affecting the success of external dacryocystorhinostomy. Orbit 2003;22(4):247-55.
32. Hartikainen J, Gremnan R, Puukka P, Seppä H. Prospective randomized comparison of external dacryocystorhinostomy and endonasal laser dacryocystorhinostomy. Ophthalmology 1998;105(6):1106-13.
33. Pandya VB, Lee S, Benger R, Danks JJ, Kourt G, Martin PA, et al. External dacryocystorrhinostomy: assessing factors that influence outcome. Orbit 2010;29:291-7.
34. Charalampidou S, Fulcher T. Does the timing of silicone tube removal following external dacryocystorhinostomy affect patients' symptoms? Orbit 2009;28(2):115-9.
35. Watkins LM, Janfaza P, Rubin PAD. The evolution of endonasal dacryocystorhinostomy. Survey Ophthalmol 2003;48:73-84.
36. Zaman M1, Babar TF, Saeed N. A review of 120 cases of dacryocystorhinostomies (DupuyDutemps and Bourguet technique).J Ayub Med Coll Abbottabad. 2003;15(4):10-2.
37. Türkcü FM1, Oner V, Tas M, Alakus F, Iscan Y. Anastomosis of both posterior and anterior flaps or only anterior flaps in external dacryocystorhinostomy.Orbit. 2012;31(6):383-5.
38. Serin D1, Alagöz G, Karsloglu S, Celebi S, Kükner S. External dacryocystorhinostomy: Double-flap anastomosis or excision of the posterior flaps? Ophthal Plast Reconstr Surg 2007; 23(1):28-31.
39. Welham RAN, Henderson PH. Results of dacryocystorhinostomy: analysis of failure. Trans OphthalmolSoc UK 1973;93: 601-9.
40. Welham RAN. Investigations for patients undergoing lacrimal surgery. Eye 1998;12:334-6.
41. Rosen N, Sharir M, Moverman DC, Rosner M. Dacryocystorhinostomy with silicone tubes: evaluation of 253 cases. Ophthalmic Surg 1989;20:115-9.
42. Tarbet KJ, Custer PL. External dacryocystorhinostomy: surgical success, patient satisfaction, and economic cost. Ophthalmology 1995;102:1065-70.
43. Harris GJ, Sacol PJ, Beatty RL. Relaxed skin tension line incision for dacryocystorhinostomy. Am J Ophthalmol 1989; 108:742-3.
44. Malhotra R,Wright M,Olver JM. A consideration of the time taken to do dacryo-cystorhinostomy (DCR) surgery. Eye 2003; 17:691-6.