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ORIGINAL

Outcome of lateral tarsal strip in managing the paralytic eyelid eversion

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Background: Paralytic eyelid eversion (ectropion) is prevalent in admitted individuals with ineffectiveness of the cranial nerve 7, brain tumor, and leprosy. Neurogenic ectropion is an unusual eyelid problem due to impairment of the 7^{th} cranial nerve, which can cause multiple difficulties due to inadequate corneal protection.

Objective: To describe the surgical efficacy of the lateral tarsal strip (LTS) technique in managing the paralytic eyelid eversion or ectropion.

Methods: This study was conducted prospectively at a third-level eye care center in Bangladesh for 3 years commencing from 2019, involving 26 patients. The included patients involved the paralytic eversion of the inferior lid who underwent LTS surgery. The principal findings, like surgical outcome, contouring of the lid, complications, follow-up time, and recurrence, were recorded. All the study subjects were examined within 14 days, and the standard follow-up period was 12 months.

Results: The full number of studied cases was 26. In this research, males represented 73%, while females accounted for 27%. The average age was 57.8 $\pm$ 14.9 years and ranged from 24 to 72. In operated cases, the right eyes were 15 cases (57.70%), and the left eyes were 11 cases (42.30%). The final better outcome of surgical modification was 93%. Twenty-four eyelids had an outstandin appearance after surgery. Mild complication includes postoperative lid swelling in seven eyelids, which was resolved within 7 days. Just two patients had mild lid eversion at the end of the follow-up schedule.

Conclusion: LTS is a simple, easy-to-maintain, and potent technique to correct paralytic eyelid eversion. It is essential to fixate the LTS above the lateral canthus to minimize new occurrence, and achieve the desired clinical outcome.

Keywords: paralytic, cicatricial, ectropion, lateral tarsal strip, facial nerve palsy

Introduction

Ectropion is the term that refers to the outward rotation or eversion of the palpebral margin and is classified into congenital, involutional, paretic, cicatricial, and mechanical (1). Paralytic ectropion or paralytic lagophthalmos is associated with patients of facial nerve damage, central nervous system malignancies, and leprosy (2). Paretic or nerve-impaired ectropion is a common ophthalmic delayed sign of 7th cranial nerve pathology, which can cause many difficulties, including vision loss due to inadequate corneal safeguard. These issues include exposure keratitis, dryness, watering, conjunctivitis, and keratinization of the conjunctiva (3, 4). Seventh cranial nerve palsy causes insufficient blinking and lid closure by impairing the function of the orbicularis oculi muscle.

In patients suffering from long-standing 7th cranial nerve damage, eyelid retraction and changes in lid skin can develop over time, potentially causing the cicatricial ectropion of the inferior eyelid (5).

Suffering individuals with keratitis due to nerve-impaired ectropion present a significant oculoplastic challenge. The dysfunction is characterized by both eyelid retraction of an eye as well as horizontal lid weakness, which can result in inferior eyelid ectropion, lagophthalmos, or sag; poses a substantial risk of exposure keratopathy, especially when coexisting corneal anesthesia is present; and demands immediate attention. Unaddressed ectropion may lead to severe consequences, including corneal ulceration, globe perforation, and even blindness.

When conservative treatment fails to safeguard the cornea adequately, surgical techniques such as palpebral slings, complete or partial eyelid apposition, inferior eyelid strengthening, or the fixation of a gold or platinum weight implant become crucial for corneal protection. In the past, lateral tarsorrhaphy was the most common technique to correct lagophthalmos and paralytic ectropion. However, these procedures may not always yield the desired outcomes, resulting in unsatisfactory cosmetic results or insufficient elevation of the lower eyelid for corneal protection.

The lateral tarsal strip (LTS) is the most frequently used operating procedure for repairing a high-grade lid eversion with facial nerve palsy due to its simple and fast procedure, which improves the inferior lid strength and helps in closing the eyelid. LTS was first proposed by Anderson and Gordy in 1979 to address lower lid laxity, which included senile or paralytic malposition. By reducing the length of the lateral tarsal plate and rebuilding the lateral canthal angle (6–8). It can successfully oppose both horizontal and vertical retraction, returning the architecture and function of the eyelids to normal, particularly in cases where the lateral canthus and lower lid are positioned abnormally (9). The outcome of LTS alone for correcting paralytic ectropion with punctal eversion remains debatable; a combination of two procedures is often helpful in achieving the optimal result (10, 11). This controversy, we believe, is a testament to the importance and relevance of our study. The LTS was generally reckoned for several other methods to improve inferior eyelid strictness. The LTS is still commonly used, particularly for correcting involutional ectropion and entropion (12). In this research, we attempted to assess the surgical outcomes of LTS procedures in patients with paralytic ectropion.

Methodology and materials

This research was conducted prospectively at the Ispahani Islamia Eye Institute and Hospital in Bangladesh for 3 years starting from January 2019. Institutional review board (IRB) approval was obtained. In our study, we included 26 individuals with longstanding 7th cranial nerve paralysis with lower lid paretic eversion who underwent LTS surgery. The exclusion criteria were individuals with senile and cicatricial ectropion and people with previous surgical history. The outcome was graded mild (outward malposition of the Inferior eyelid, no ocular symptoms), moderate (eversion of the inferior eyelid with mild symptoms), severe (eversion of the inferior eyelid with the exposure of the palpebral conjunctiva or full lower lid, away from the eyeball, with epiphora and conjunctivitis), extreme (severe eversion along with keratitis). Written consent was taken from each participant of the study subjects.

All data were stored systematically in a preformed data collection form. The mean and standard deviation were demonstrated as numerical data, while the repeatable distribution and percentage were shown as non-numerical data. The test of significance, like the chi-square test was performed in this study. The major features evaluated and included the results of the procedure (outcome), postsurgical cosmesis, adverse effects, and reoccurrence in the follow-up time. All patients were evaluated within 2 weeks, and the average follow-up period was 12 months. The statistical software (SPSS 22) was used to do the statistical analysis. A probability value <0.05 was stated as a level of significance.

Surgical procedure

The surgery was performed under local anesthesia. A lateral canthotomy incision was given, measuring approximately 5–10 mm, and a dissection was done to explore and expose the periorbita of the lateral wall of the bony orbit. A lower limb cantholysis might be performed. The tarsal strip was fashioned to be approximately 5–10 mm in length (**Figure 1a**), depending on the grade of inferior lid weakness and the deviation between anterior and posterior lamellae of the temporal part of the eyelid. The skin and muscle overlying the tarsal strip was excised and the conjunctiva of the temporal tarsus strip was scraped. The lateral tarsus strip

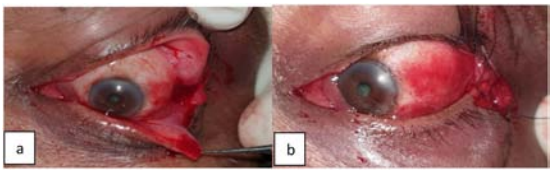

FIGURE 1 | (a) Lateral tarsus strip created, (b) Fixation of tarsal strip with periosteum.

TABLE 1 | The demographic and clinical characteristics of our study patients.

Characteristics	N	P(%)
Mean age (year)	57.80 ± 14.9	
Range	24–72	
Gender		
Male	19	73
Female	7	27
Laterality		
Unilateral	26	100
Number of eyelids (affected eyelids)		
Lower eyelid (RE)	15	57.69
Lower eyelid (LE)	11	42.31
Severity of ectropion		
Mild	10	38.46
Moderate	12	46.15
Severe	4	15.38
Extreme	0	0.00
Preoperative symptoms (affected eyes)		
Ocular pain	2	7.69
Dry eye syndrome	12	46.15
Conjunctivitis	8	30.77
Epiphora	2	7.69

was then sutured to the periorbita just inner of the orbital rim at least 2 mm superior to the level of the transverse canthal line by 5/0 proline suture (**Figure 1b**). The temporal canthal angle was reformulated, and skin and orbicularis closure were performed with 6/0 Vicryl sutures.

Results

This research reported a total of twenty-six study subjects with long-standing 7th cranial nerve palsy with inferior lid paralytic ectropion who underwent the LTS technique.

We found the average age was 57.80 ± 14.9 years (**Table 1**). The majority of our patients were male (73%) compared to female (27%).

The right eyes were operated on in 15 (57.70%) patients, and the left eyes in 11 (42.30%). Most of the eyelids of our studied individuals showed a moderate grade of ectropion (46.15%). Ten eyelids (38.46%) showed a mild grade, only four eyelids (15.38%) showed a severe grade, and none had an extreme grade of ectropion. Among preoperative symptoms, the most common were dry eye syndrome (46.15%) and conjunctivitis (30.77%). Both ocular pain and epiphora were found in 7.69% of our patients.

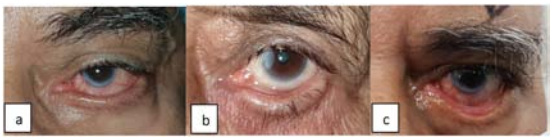

FIGURE 2 | (a) Mild, (b) Moderate, (c) Severe paralytic eversion of the lower lid in facial nerve palsy.

TABLE 2 | Distribution of our patients based on their postoperative anatomical improvements.

Number of patients	Postoperative improvements					p-value
	Grade	Excellent	Worse	Same	Total	
Lower lids ectropion	Mild	10	0	0	10	>0.05
	Moderate	11	0	1	12	
	Severe	3	0	1	4	
	Extreme	0	0	0	0	
	Total	24	0	2	26	

We describe the severity of eyelid eversion (**Figure 2**), and **Table 2** shows the observed better improvements postoperatively for different severities of inferior eyelid ectropion (eversion).

Among the patients, 24 (92%) had an excellent alignment of their eyelids following the operative procedure (**Figures 3** and **4**), and only 2 (8%) showed no improvement. There was no statistical significance between better postoperative results and the severity of the ectropion ($p > 0.05$).

In this study, **Table 3** presents the postoperative complications experienced by our patients. Most of our patients (20, 77%) had no complications, followed by mild postoperative lid swelling in 27%, which spontaneously regressed in a week. Low-grade pain and minimal inversion of the lid margin are experienced in about 8% of all participants.

Discussion

The inadequate function of the 7th cranial nerve leads to the loss of the tone of the orbicularis oculi (O.O.) muscle, which causes the edge of the eyelid to turn outward (13). Ocular exposure resulting in conjunctival keratinization, watering, discomfort, and impaired visual acuity are common consequences of severe lower eyelid ectropion. There are several techniques available to strengthen horizontal laxity of the inferior lid. The most used technique today is the LTS procedure for correcting paralytic ectropion (1). This

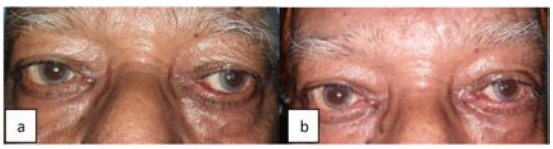

FIGURE 3 | (a) Moderate ectropion of left lower lid, (b) postoperative 2 weeks after lateral tarsal strip (LTS) procedure.

FIGURE 4 | (a) Severe eversion of the left inferior lid, (b) Postoperative 3 years after the LTS procedure.

TABLE 3 | Distribution of studied patients by postoperative complications.

Complications	Number of eyelids	Percentage (%)
No complications	20	77
Mild lid oedema	7	27
Mild persistence of ectropion	2	8
Mild pain	2	8

procedure was first reported by Anderson and Gordy (6) in 1979, when they described it and suggested its use for entropion occurring from the weakness of the lateral canthus (3).

A simple physical examination can easily diagnose paralytic ectropion; however, addressing the clinical and aesthetic issues is always challenging to manage and may even result in vision impairment if left untreated (14, 15). The major aims of therapy are to maintain corneal moisture by using tear substitute lubricating drops and gel (14, 15). Physical therapy and facial massage may help manage lid ectropion, such as forcefully closing the eyes many times a day or taping them closed during sleep (14). Surgery can be performed in cases of exposure keratopathy where conventional treatments are not effective, and it can also be performed for cosmetic issues. Non-surgical treatments may help to prevent vision-threatening complications; however, eyelid surgery is the only option that consistently gives satisfactory results (14, 16). The most common surgical technique for repairing lid eversion is LTS, a quick and safe procedure.

In our study, the average age was 57.80 ± 14.9 years with a range from 24 to 72 years. Jue et al. found the average age was 71.4 ± 7.9 years (15). Kwon et al. reported the result was 54.6 ± 28 years (17).

In our study, the success rate of surgical correction was 93%. Kim et al. expressed that approximately 90% of leprosy patients who underwent the LTS technique were satisfied with the results (18). In addition, Jue et al. found that most of their patients were satisfied with the outcomes, and the mean scale of patient global assessment was 2.6/3 at the end of the follow-up period, which was similar to that of other studies (15).

A grading system described by Moe and Linder elaborately classifies eyelid eversion into four categories: mild, moderate, severe or marked, and very severe or extreme (19). In our study, most of the eyelids of our patients exhibited a moderate degree of ectropion (46.15%); 10 (38.46%) eyelids showed a mild degree, and only 4 (15.38%) eyelids showed a severe degree. Jue et al. reported a moderate grade, with no one experiencing an very severe or extreme degree (15). While the LTS technique is fitted for mild to moderate degrees of ectropion, patients with marked and extreme degrees require additional or more radical methods, such as wedge resection for the former and temporalis muscle transfer for the latter (15).

In our study, there was no recurrence rate. Jue et al reported that in their study, the recurrence rate was 11.4% (5/44). While patients with mild and moderate degrees of ectropion showed recrudescence rates of 0% (0/5) and 9.4% (3/32), respectively, 66.7% (2/3) of patients with a marked degree of ectropion had a recurrence during the follow-up period (15).

In our study, most of our patients (20, 77%) had no complications, followed by mild postoperative lid edema (27%), which was resolved within 1 week. Mild pain was associated with a mild degree of ectropion that was reported in 8% of patients. Chang & Olver identified complications, including a little skin fold at the lateral canthus, suture exposure that was trimmed under slit lamp examination, and aberrant regeneration with blepharospasm, as well as crocodile tears (20). Jue et al. found no extreme postoperative complications, except for a small size discrepancy of approximately 1–2 mm in both eyes in two patients (15). Putterman et al. reported few complications, with no severe complications, including infection, wound dehiscence, avulsion of the tarsus strip, tenderness at the new canthal suturing site, or granulomas (21).

Several series attest to the effectiveness of the LTS in paralytic eversion (15, 22). Many support the fusion of lateral (often small-scale) tarsorrhaphy with the LTS (17, 20). As it is assumed that the operation may only be momentarily successful with a certain rate of recurrence, surgeons frequently strive for a little bit higher postsurgical position of the inferior eyelid in patients with paralytic LTS (20). According to certain articles, there is a better success rate in the 3-year follow-up when reanimation surgery is combined with LTS (23). Kadir et al. (24) show the better outcome in managing both entropion and ectropion.

Therefore, those with mild to moderate paralytic ectropion are much better candidates for the LTS, whereas severe ectropion patients need to undergo other or additional treatments. The unifying goal of LTS treatment is to restore eyelid marginal malposition through horizontal tightness

and canthal elevation, with the rebuilding of a new lateral canthus. Nevertheless, other articles describe the surgical approach in different ways (6, 15, 21, 25). A few crucial components, like a strong attachment to the periorbita, the excision of conjunctiva within the tarsus strip, and a slight overcorrection, can be readily highlighted to accomplish the goal (25–28).

Our study was conducted at a single center, which involved a small sample size due to the limited time available for our research. After evaluating the patients, we did not follow-up them for a long time, so we do not have information about the long-term effects or whether any recurrence occurred.

Conclusion

Lateral Tarsal Strip (LTS) is unique, safe, and effectual technique for correcting paralytic eversion to achieve the desired clinical outcome.

Ethical statement

The Institutional Review Board approved the research.

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There is no financial sponsor/research fund to do the research.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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