

Inferior Vena Cava Collapsibility Index in Correlation with Central Venous Pressure and Cardiac Output

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Abstract

Background: The inability to move or feel anything that the facial nerve (FN) innervates is known as facial nerve paralysis (FNP). There are multiple potential causes of FNP due to the lengthy and sometimes complicated FN pathway.

Aim: The purpose of this study was to evaluate the lagophthalmos and adjust the position of the upper and lower lids in FNP patients who had undergone lateral tarsal strip (LTS) surgery in conjunction with blepharotomy.

Methods: This prospective study was carried out on 30 patients aged from 19 to 65 years old, both sexes, with lagophthalmos, FNP more than 6 months, epiphora, lower lid ectropion, exposure keratopathy and bad cosmeses. All patients were subjected to LTS and blepharotomy evaluation.

Results: Regarding the amount of lagophthalmos (mm), brow ptosis, and anterior segment examination preoperative and postoperative of the studied group, there were significant differences (p -value<0.05). Regarding minor complications, wound infection occurred in 2(6.7%) patients, a small excess skin fold in the upper lid occurred in 4(13.3%) patients, and an irritating suture at the slit lamp at the lateral canthus occurred in 2(6.7%) patients.

Conclusions: LTS combined with blepharotomy significantly improves eyelid function, reduces ocular surface complications, and enhances patient satisfaction in cases of chronic facial nerve palsy. While some minor complications were observed, they were not severe enough to outweigh the benefits of the procedure.

Keywords: Lateral Tarsal Strip; Blepharotomy; Facial Nerve Palsy; Lagophthalmos

1. Introduction

One prevalent issue is facial nerve paralysis (FNP), which causes paralysis in any areas that are innervated by the facial nerve (FN). There are a lot of potential causes of FNP due to the lengthy and sometimes complicated FN route.¹

Some common causes of facial neuropathy (FNP) include: Bell's palsy, infections (such as herpes zoster virus or secondary otitis media), blunt trauma to the temporal bone, tumors (such as cholesteatomas, haemangiomas, acoustic neuromas, parotid gland neoplasms, or metastases of other tumors), strokes in the pontine arteries that supply the FN nucleus, diabetes mellitus, sarcoidosis of the nervous system, and Guillain-Barré syndrome (an autoimmune condition of the peripheral

nervous system).²

Apparent at any age, Bell's palsy is another name for sudden paralysis of the periphery of the face. There is no known cause for this. The theory is that it develops when the nerve that regulates the facial muscles on one side experiences inflammation and swelling. Another possibility is that it's a response to a virus. Bell's palsy symptoms can manifest quickly and include a gradual weakening or complete paralysis of one side of the face, difficulty with closing the eyelids, a drooping eyebrow, difficulty making facial expressions, ectropion, lagophthalmos, brow ptosis, lid retraction (which was obscured by brow ptosis), epiphora, facial drooping, difficulty with closing the eye, sagging of the lower eyelid, and a weakening of the corner of the mouth.³

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An inferior cantholysis follows a lateral canthotomy in the lateral tarsal strip (LTS) operation. Next, the posterior lamella strip is carefully inserted along the lateral orbital rim, reaching the level of Whitnall's tubercle, which is at least 2mm above the medial canthus.⁴

uring a browpexy, sutures that do not absorb are used to attach the lateral brow fat pad to the deep temporalis fascia, which is located slightly above the orbital rim. Although this method gives a little brow lift, it could cause noticeable skin dimpling.⁵

Blepharotomy is any surgical procedure that involves cutting into the eyelids at any point. Cosmetic enhancement of eyelid malposition, symptomatic relief of lagophthalmos and dry eyes, and predictable surgical treatment for mild to severe eyelid retraction caused by thyroid eye disease, cicatricial trauma, graft-versus-host disease, and paralytic FNP are all possible outcomes of a full-thickness graded blepharotomy technique that involves incisions made through the levator aponeurosis, Müller's muscle, and conjunctiva.⁶

The aim of this work was to assess the lagophthalmos and correction of upper and lower lid position after LTS combined with belaphorotomy in FNP.

2. Patients and methods

Thirty patients, ranging in age from nineteen to sixty-five, were included in this intervention prospective investigation, both sexes, with lagophthalmos, FNP more than 6 months, epiphora, lower lid ectropion, exposure keratopathy, and bad cosmetology. This study has been conducted from April 2022 to December 2024.

Ethical consideration:

The study was approved by the Medical Research Ethics Committee (MREC) of Al-Azhar University Hospitals, Cairo, Egypt. Informed written consent was obtained from the patients.

Exclusion criteria:

Were renal or hepatic failure, pregnant or lactating mothers, uncontrolled diabetic or hypertensive patients, allergic and asthmatic patients, patients refused surgical intervention, FNP less than 6 months, blind painful eyes, eviscerated globe, other ocular nerve affection, mild symptoms, or had no complaint.

All patients were subjected to complete history taking and clinical examination.

Preoperatively, assessment of brow ptosis (normal brow level is at the level of superior orbital rim), size and shape of palpebral aperture (range:9-13 mm vertically, 25-30mm horizontally), position of eye lid (normal position of the upper lid: covers 1-2mm from the upper limbus and normal position of the lower lid is tangential with

the lower limbus), the motility of eye lid (lid elevation, lid closure and blinking), lid margin (position as regard ectropion or entropion, puncta, presence of any defects, scales, dandruff or infections), lid crease examination (normal position 7-10mm above eye lid margin), skin of the eye lid (texture, pigmentation, edema, swelling, vesicles and rash) and lower lid horizontal laxity.

When looking for widespread skin laxity, the pinch test is reserved for the lower eyelid. Tells the patient to keep their mouth open as they gaze upwards. The examiner uses their fingers or silky forceps to grab the skin of the lower eyelid beneath the lashes. The next step is to determine how far away from the globe the lid can be distracted.

To determine the degree of orbicularis oculi muscle tone, a method called the Snapback test is employed to measure lower lid laxity. When the lower eyelid is completely displaced, the center section is dragged inferiorly away from the globe. In a normal lower eyelid, the lid should snap back into place over the pupil as soon as you let go of it. How quickly the bottom lid returns to its spherical shape determines the grade.

Medial canthus tendon (MCT) laxity grading systems, 0: focus unbroken. +1: The punctum has reached the middle of the medial plica. 2: the punctum reaches the medial limbus. 3: the punctum reaches the halfway point between the medial limbus and the pupil. The punctum reaches the pupil line at time +4. +1: the punctum reaches the halfway point between the lateral limbus and the pupil. +6: punctum reaches lateral limbus (very unusual).

Lateral canthus laxity

The sides of the canthus are rounded. The canthal angle moves more than 2 mm, and the eyelid is dragged medially. Analyzing the tear film (find the meniscus's vertical height). Check the area of the medial canthal region. On the exam, check for swelling, drainage, fistulas, and lumps. One way to check for corneal injury or foreign objects in the eye is with a fluorescein eye stain, which uses an orange dye (fluorescein) and a blue light. The regurgitation test involves applying pressure on the lacrimal sac; usually, it comes out negative in healthy individuals, but it might be positive in cases of chronic dacryocystitis and nasolacrimal duct blockage (NLDO). A functional or mechanical blockage of the drainage system might be indicated by a prolonged retention of the fluorescein dye, which should dissipate after 5 minutes after two drops of the dye have been placed in the conjunctival sac. Lacrimal syringing test. The Jones dye test is used to distinguish between excessive secretion and inadequate drainage when there is partial obstruction. The Jones 2-test is used to distinguish between partial obstruction and pump failure when there is partial obstruction. Both eyes are examined

simultaneously during the Schirmer's test, which is mainly employed to diagnose dry eye. Inserting the inferior fornix, the lower eyelid, with a thin strip of filter paper. For five minutes, the eyes are closed. After that, we removed the paper and measured the moisture content. When the five minutes have passed, the standard is a wetness of the paper of at least 10 mm after 5 minutes. Insufficient number of tears, which is less than 5mm of paper wetness after 5 minutes.

Following a lateral canthotomy, inferior cantholysis, and the fixation of a posterior lamella strip to the lateral orbital rim at the level of Whitnall's tubercle, all patients underwent LTS to correct the position of their lower lids.

Lateral tarsal strip surgical technique

We used a 27-gauge needle to inject around 3–5 milliliters of a mixture of 2% lidocaine and 1:200,000 epinephrine into each patient's lateral canthal angle, lateral eyelid, and around their lateral orbital rim while they were all under local anesthesia for the procedure. A lateral canthotomy was performed to improve homeostasis. After the outer canthus was crushed using mosquito forceps, the vertical cutting motion of the Westcott scissors was initiated, and the cutting continued for approximately 10mm. To further mobilize the lower eyelid and identify the orbital periosteum, we used oblique and nasally directed scissors to cut through the lower crus of the lateral canthal tendon, which allowed us to detach the tendon attachments from the lateral orbital rim. The lower eyelid was then subjected to a full-thickness horizontal cut measuring about 6-10mm. The tarsal strip was exposed and prepared by making a second, higher subciliary incision line that was the same length as the first horizontal cut. The skin, subcutaneous tissue, and underlying orbicularis were removed. Using bipolar diathermy, the lid margin that corresponded to the LTS was de-epithelialized, and the lashes and conjunctiva were ablated. We gently tugged the strip over the lateral canthus angle to show the excess length that needed to be cut. In addition, a half-circle needle was used to suture the strip to the periosteum, which was visible on the inside of the orbit's lateral wall, with a Polyester 4/0 double-armed non-absorbable suture. In addition, we inserted the two needles through the lateral canthal tendon stump or into the orbital rim to exit the periosteum. In order to prevent the initial condition from returning after the operation, we sealed the sutures to prevent postoperative dehiscence. Lastly, we used 6-0 Vicryl to seal the orbicularis muscle and skin in two layers.

Administer lubricant eyedrops, a combination of tobramycin and dexamethasone eye drops and ointment, as well as systemic antibiotics, nonsteroidal anti-inflammatory drugs, and alpha

chymotrypsin tablets to all participants for 21 days following surgery. The sutures were then removed 10 days later. Transects were made through one or more layers of the eyelid lamella to perform blepharotomy on patients who retracted their upper lids. In cases of brow ptosis, the lateral brow fat pad was secured to the deep temporalis fascia during a browpey procedure. When the lacrimal pump fails to drain the lacrimal sac of excess fluid and mucus, the patient may undergo dacryocystorhinostomy (DCR).

Each patient was evaluated following surgery at one, two, and three-month intervals for factors such as lower and upper lid position, ectropion, lid laxity, retraction, exposure keratopathy, epiphora, lagophthalmos, and bad cosmetology.

Statistical analysis

We used SPSS (Statistical Package for the Social Sciences) 27 to examine the data. The mean±standard deviation was used to express continuous data. The Paired-Samples T-test was used to find differences between the pre- and postoperative periods. We used the Chi-square test to find differences between the two groups, and we reported nominal data as percentages. Statistical significance was determined by a two-tailed $p < 0.05$.

3. Results

Demographic data, eye side, causes of facial palsy, duration of palsy ophthalmological symptoms and signs of the studied patients were enumerated in [table 1](#).

Table 1. Demographic data, eye side, causes of facial palsy, duration of palsy ophthalmological symptoms and signs of the studied patients

N=30		
SEX	AGE(YEARS)	55.53±15.32
	Male	13(43.3%)
EYE SIDE	Female	17(56.7%)
	Right	14(46.7%)
CAUSES OF FACIAL Palsy	Left	16(53.3%)
	Bell's palsy	15(50.0%)
	Infection	8(26.6%)
	Trauma	6(20.0%)
DURATION OF Palsy (YEARS)		2.37±1.24
		Cerebrovascular disease 1(3.3%)

Data are presented as mean±SD or frequency (%).

Regarding amount of lagophthalmos(mm), brow ptosis, anterior segment examination preoperative and postoperative of the studied group there were significant difference (p -value<0.05). [Table 2](#)

Table 2. Amount of lagophthalmos(mm), brow ptosis, anterior segment examination preoperative and postoperative of the studied group

	PREOPERATIVE	POSTOPERATIVE	P-VALUE
AMOUNT OF LAGOPHTHALMOS (MM)	7.23±1.99	1.43±1.45	<0.001**
AMOUNT OF BROW PTOSIS (MM)	1.89±0.76	1±0	0.014*
AMOUNT OF LID RETRACTION (UPPER LID POSITION) (MM)	2.25±0.68	1.33±0.52	0.014*
ANTERIOR SEGMENT EXAMINATION			
PUNCTATE EPITHELIAL EROSION	27(90.0%)	5(16.7%)	<0.001**
INJECTION	No	6(20.0%)	<0.001**
	Mild	19(63.3%)	
	Moderate	7(23.3%)	
		3(10.0%)	

Data are presented as mean±SD or frequency (%).

Operations, postoperative patient satisfaction and postoperative follow up of studied group were enumerated in table 3.

Table 3. Operations, postoperative patient satisfaction and postoperative follow-up of studied group

OPERATIONS		N=30
LATERAL TARSA STRIP ONLY		6(20.0%)
LATERAL TARSA STRIP AND BLEPHAROTOMY		6(20.0%)
LATERAL TARSA STRIP WITH BROW PEXY		8(26.7%)
LATERAL TARSA STRIP WITH BROW PEXY AND BLEPHAROTOMY		10(33.3%)
POSTOPERATIVE PATIENT SATISFACTION		25(83.3%)
POSTOPERATIVE FOLLOW UP	Completely improvement	19(63.3%)
	Minor dryness	7(23.3%)
	Still complain	4(13.3%)

Data are presented as mean±SD or frequency (%).

Regarding minor complication, wound infection occurred in 2(6.7%) patients, small excess skin fold in upper lid occurred in 4(13.3%) patients and experienced irritating sutured at slit lamp at lateral canthus occurred in 2(6.7%) patients.

Table 4

Table 4. Minor complication of studied group.

MINOR COMPLICATION		N=30
WOUND INFECTION		2(6.7%)
SMALL EXCESS SKIN FOLDS IN UPPER EYELID		4(13.3%)
EXPERIENCED IRRITATED SUTURED AT SLIT LAMP AT LATERAL CANTHUS		2(6.7%)

Data are presented as mean±SD or frequency (%).

Cases presentation:

Case one



A) Before

B) After

Figure 1. Male patient with lagophthalmos grade 3 caused by facial nerve palsy. A) represented the case before operation. B) represented the case after the operation

Case Two



A) Before

B) After

Figure 2. Female patient grade 3 lagophthalmos

caused by facial nerve palsy. A) represented the case before operation. B) represented the case after the operation.

Case three



A) Before

B) After

Figure 3. Female patient grade 2 lagophthalmos caused by facial nerve palsy. A) represented the case before operation. B) represented the case after the operation

4. Discussion

FNP is a debilitating condition that can result in multiple periocular and ophthalmic complications, such as paralytic ectropion, lower eyelid retraction, lagophthalmos, and exposure keratopathy. These complications occur due to the weakening of the orbicularis oculi muscle, which is essential for eyelid closure.⁷ The resulting dysfunction contributes to horizontal lid laxity and lower eyelid retraction, increasing the risk of progressive exposure keratopathy and associated vision-threatening sequelae.⁸

In our study, causes of facial palsy included Bell's palsy in 50.0% patients, infection in 26.7% patients, trauma in 20.0% patients, and cerebrovascular disease in 3.3% patients. The duration of palsy was, with a mean value(±SD) of 2.37(±1.24) years.

Supporting our findings, Ragaban et al.,⁹ showed that there are several etiologies of FNP. Of the cases of one-sided FNP, 70% are caused by Bell's palsy. Bell's palsy emerged as the primary cause. Trauma accounts for 10-23% of cases. Additionally, Infections and strokes can cause FNP.

Also, Chung et al.,¹⁰ reported that the causes of facial palsy, bell's palsy was present in 26% patients, but infection was present in 10% patients, and the trauma was present in 16% patients. This difference may be attributed to different populations and geographic areas.

Postoperative lagophthalmos was much less than preoperative lagophthalmos in this investigation. Postoperative browptosis was much less than preoperative browptosis. Postoperatively, there was a marked decrease in

the amount of lid retraction, also known as the upper lid position, compared to preoperatively.

The facial nerve that innervates the orbicularis oculi muscle, the zygomatic branch, passes through a thin layer of tissue that is cooler than the surrounding areas when it traverses the malar eminence of the zygomatic bone. When this branch is involved, it causes lagophthalmos, ectropion, and entropion, and it paralyzes the orbicularis oculi muscle, which is responsible for shutting the eyelids. Antibacterial chemotherapy can prevent paralysis to some extent, but once it has set in, there is usually little to no chance of recovery.¹¹

This supported by Huang et al.,¹² stated that browpexy prevented brow ptosis after blepharoplasty with skin excision and had substantial brow-lift effects.

Along with our findings, Kopecký et al.,¹³ mentioned that LTS had the potential to effectively reposition the eyelid while also restoring and enhancing its lateral fixation.

Nevertheless, Jowett et al.,¹⁴ noted that lateral wedge resections and lower lid sagging surgery (LTS) can often resolve paralytic lagophthalmos' horizontal laxity and malposition; however, both procedures may show signs of corrective deterioration over time.

Postoperative punctate epithelial erosion was far less common than preoperative erosion, according to our results. A substantial decrease in moderate injection occurred after surgery compared to before.

Patients with paralytic lagophthalmos, where FNP impairs eyelid closure, conjunctival injections commonly occur due to ocular surface exposure, leading to redness and irritation. Moderate injections, indicating a medium level of conjunctival redness, are often observed preoperatively due to chronic inflammation and dryness. However, postoperative improvements in eyelid functions led to a significant decrease in conjunctival injection.

This highlights the effectiveness of surgical intervention in improving both functional and aesthetic outcomes, ultimately enhancing ocular health and patient comfort.¹⁵

This is supported by Sanchez et al.,¹⁶ who reported that in patients with paralytic ectropion, outcomes of LTS added advantages of symmetry without lateralization or caudalization of the lower medial punctum.

Supporting our findings, Lawrence et al.,¹⁷ mentioned that a tightening procedure such as a LTS would improve apposition of the lower eyelid to the globe and decrease tearing.

In the presents study, 83.3% of patients were satisfied. Regarding postoperative follow-up, 63.3% of patients improved, 23.3% of patients suffered from minor dryness, and 13.3% patients

still complained.

Supporting our findings, Wali et al.,¹⁸ showed that the primary advantage of the LTS procedure was rapid recovery and favorable cosmetic results. The procedure consistently delivered satisfactory outcomes, both functionally and aesthetically.

In the same line, Khan et al.,¹⁹ found that 93.5 percent of cases were satisfactorily corrected surgically. When it came to correcting paralytic ectropion and involutional eyelid marginal malpositions, the LTS method yielded statistically significant improvements in both anatomy and function.

In the current study, regarding minor complications, wound infection occurred in 6.7% patients, a small excess skin fold in the upper lid occurred in 13.3% patients, and irritation from sutured at the slit lamp at the lateral canthus occurred in 6.7% patients.

In the same line, Wali et al.,¹⁸ reported that complications after surgery were minimal, one patient suffered infection of suture site at medial canthus.

Also, Clauss et al.,²⁰ found that the postoperative complications following LTS were minimal. Common complications of LTS surgery were wound dehiscence, focal rim tenderness and infection requiring antibiotics.

Limitations:

Limitations of the study included that the sample size was relatively small. The study was in a single centre, we didn't identify risk factors for these complications that would help refine the procedure and we didn't compare with other procedures.

4. Conclusion

LTS combined with blepharotomy significantly improves eyelid function, reduces ocular surface complications, and enhances patient satisfaction in cases of chronic facial nerve palsy. While some minor complications were observed, they were not severe enough to outweigh the benefits of the procedure.

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