Double Rectangle Fascia Lata Frontalis Sling: A Rationale Approach for Ptosis

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Abstract

Keywords

- ptosis
- surgical correction
- frontalis sling
- fascia lata
- double rectangle pattern

Background The purpose of this study was to evaluate the functional outcomes of a modified technique of double rectangle pattern for correction of severe ptosis.

Methods This is a retrospective study over a period of 8 years including patients who underwent correction of ptosis by double rectangle using autologous fascia lata sling. Surgical outcomes were assessed postoperatively by distance from the corneal light reflex to the upper eyelid margin (MRD1) and levator function.

Results Twenty-six eyelids were operated in 20 patients. There were 9 males and 11 females, with age ranging from 4 to 35 years. Preoperatively, all patients had poor MRD1 and poor levator function. Postoperative MRD1 was good in 13 patients (17 eyelids), fair in 5 (7 eyelids), and poor in 2 patients (2 eyelids). Postoperative levator function was excellent in 12 patients (15 eyelids), good in 6 (9 eyelids), and fair in 2 patients (2 eyelids). At a mean follow-up of 12 months, adequate correction was achieved in 24 eyelids, and 2 eyelids had undercorrection.

Conclusion Frontalis sling with a double rectangle is simple and more efficient, as it provides a straight line of pull to the eyelid for correction of severe ptosis.

Introduction

Frontalis sling surgery using autogenous fascia lata is the standard treatment for severe ptosis, which creates a linkage between the frontalis muscle and the tarsus of the upper eyelid; elevation is then performed with the use of the frontalis muscle. Several patterns are described for the fixation of fascia lata to the tarsal plate.¹⁻⁵ Many of these methods are complicated, do not provide a straight line of pull, resulting in loss of power, and putting more strain on the sling; additionally, some of them require the Wright needle and are associated with more dissection and scarring. This study describes a simple and effective technique of frontalis sling, with a modified double rectangle pattern made of autologous fascia lata for treatment of ptosis.

Material and Methods

This is a retrospective study of 20 consecutive severe ptosis patients who underwent frontalis sling surgery with a double rectangle using fascia lata from 2010 to 2018 in the plastic surgery unit of a tertiary referral centre in central India. Medical records of all patients with severe ptosis who underwent frontalis suspension with modified double rectangle pattern using autologous fascia lata in the last 8 years were reviewed. Institutional ethics committee's approval was obtained, and all patients gave written informed consent for surgery as well as for photography and publishing. All patients with severe ptosis of > 4.00 mm and levator function of < 4.00 mm with visual axis obstruction were included. Patients who had previous eyelid surgery, absent Bell's phenomenon, dry eye,

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blepharophimosis, Marcus–Gunn jaw-winking synkinesis, neurogenic and traumatic ptosis were excluded.

After a detailed history, patients' workup included routine ocular examination and complete examination for ptosis (assessment of the position of the eyelid crease, palpebral fissure height, levator muscle function, and MRD1). Grading of ptosis was done according to MRD1: mild ptosis when MRD1 was 1.5 mm, moderate when 0.5 mm, and severe when MRD1 was below 0.5 mm.

Postoperative results were evaluated by measuring MRD1 and levator function. Based on postoperative MRD1, surgical outcomes were categorized as good (≥ 3 mm), fair (MRD 2–2.9 mm), or poor (MRD < 2 mm). Levator function was classified as excellent (13 to 15 mm), good (8 to 12 mm), fair (5 to 7 mm), and poor (4 or less).⁶ Complications like recurrence, infection, lagophthalmos, and exposure/keratitis were recorded. The postsurgical evaluation was performed at 6 weeks. The mean duration of follow-up was 12 months.

Surgical Technique

Surgery was performed under general anesthesia for children and monitored anesthesia in adults. Three equidistant horizontal 2 mm incisions were made in the upper eyelid, 5 mm above the lash line through the skin down to the tarsus. Three equidistant horizontal 3 mm incisions were made above the upper border of the eyebrow in the skin and the subcutaneous tissues to reach the frontalis muscle. With the help of fine mosquito artery forceps, subcutaneous tunnels were made, and all incisions were connected through the subcutaneous plane. Fascia lata was harvested by making a 6-cm skin incision on the lower lateral thigh. Skin and subcutaneous tissue were dissected to expose the fascia lata. A scalpel was used to make parallel incisions on the fascia 3 mm wide, and 10 cm long two slips were harvested for each eyelid. The fascia layer was closed with vicryl 2–0. The skin was closed with 3–0 vicryl subcuticular sutures. The fascia slips were then cleaned of connective tissue and inserted in the ptotic eyelid in a double rectangle (open superiorly) pattern (►Fig. 1). The first two middle limbs of the double rectangle were sutured to the midpoint of the tarsal plate with a nonabsorbable 5–0 nylon. Two lateral limbs of the double rectangle were then sutured to two lateral ends of the tarsal plate (►Fig. 2). The height of the eyelid was adjusted by pulling the central two limbs of sling and keeping the edge of the upper lid just at the superior border of the limbus. Central two limbs of fascia lata were fixed with frontalis muscle using nonabsorbable 4–0 nylon. The lateral two limbs were now pulled, and tension was adjusted to achieve symmetry and contour and fixed with frontalis muscle with 4–0 nylon. Extra length of fascia lata was trimmed. Eyelid and eyebrow skin incisions were closed with a 5–0 nylon suture. After completion of the procedure, moxifloxacin 0.5% eye ointment was applied to the cornea. Tab. amoxicillin and clavulanic acid and tab. paracetamol were given to every patient for 5 postoperative days.

Results

Twenty-six eyelids (6 bilateral and 14 unilateral) of 20 patients were operated. There were 9 males and 11 females with ages

Fig. 1 Double rectangle (open superiorly) pattern of autologous fascia lata frontal sling.

Fig. 2 Per-operative picture of ptosis correction with double rectangle fascia lata frontal sling.

ranging from 4 to 35 years (mean 17.9 years). As many as 13/20 patients had acquired ptosis, while 7 had congenital ptosis. Preoperatively, all patients had poor MRD1 and levator function. Postoperative MRD1 was good in 13 patients (17 eyelids), fair in 5 (7 eyelids), and poor in 2 patients (2 eyelids). Postoperative elevation of lid was excellent in 12 patients (15 eyelids), good in 6 (9 eyelids), and fair in 2 patients (2 eyelids). (►Figs. 3–6) At the mean follow-up of 12 months, adequate correction was achieved in 24 eyelids and 2 eyelids had under correction (►Table 1). Late follow-up showed lid fissure, and lid crease were symmetrical in all cases and there was no recurrence. There were no complications like infection, lagophthalmos in downward gaze, or corneal exposure/keratitis. Two eyelids with undercorrection were treated by tightening of the sling. There were no complications related to the harvest of fascia lata; thigh scars were small and acceptable in all patients.

Discussion

The aim of sling surgery for ptosis correction is both functional and cosmetic. An ideal sling surgery should result in eyelids that

Fig. 3 Pre- and postoperative picture of right sided congenital ptosis correction with double rectangle fascia lata frontalis sling.

Fig. 4 Pre- and postoperative picture of right sided congenital ptosis correction with double rectangle fascia lata Frontalis sling.

are matched in all positions of gaze, have synchronous blinking movements, normal contour, eyelids closure during sleep, and no exposure keratitis. The frontalis suspension is performed for severe ptosis (> 4 mm) with poor levator function (< 4 mm).

Fig. 5 Pre- and postoperative picture of right-sided congenital ptosis correction with double rectangle fascia lata frontalis sling.

Fig. 6 Six months follow-up of bilateral acquired ptosis.

Table 1 Demographic details of patients and outcome of surgery

S no	Age	Sex	Site	Diagnosis	Pre op levator function	Postop MRD1	Postop levator function	Complications
1	30	F	Left eye	Ptosis	Poor	Good	Excellent	
2	27	M	Bilateral	Ptosis	Poor	Good	Excellent	
3	5	M	Left eye	Congenital Ptosis	Poor	Good	Excellent	
4	19	F	Bilateral	Ptosis	Poor	Good	Excellent	
5	28	M	Left eye	Ptosis	Poor	Poor	Fair	Undercorrection
6	9	F	Bilateral	Congenital ptosis	Poor	Fair	Good	
7	5	M	Left eye	Congenital Ptosis	Poor	Good	Excellent	
8	14	F	Right eye	Ptosis	Poor	Good	Excellent	
9	25	M	Left eye	Ptosis	Poor	Fair	Excellent	
10	25	M	Left eye	Ptosis	Poor	Good	Excellent	
11	7	F	Bilateral	Congenital ptosis	Poor	Good	Good	
12	20	M	Right eye	Ptosis	Poor	Fair	Fair	
13	10	F	Bilateral	Ptosis	Poor	Good	Excellent	
14	4	F	Left eye	Congenital Ptosis	Poor	Good	Good	
15	9	M	Right eye	Ptosis	Poor	Fair	Good	
16	6	F	Right eye	Congenital Ptosis	Poor	Poor	Fair	Under correction
17	20	F	Right eye	Ptosis	Poor	Good	Excellent	
18	30	F	Left eye	Ptosis	Poor	Good	Excellent	
19	30	F	Bilateral	Congenital Ptosis	Poor	Fair	Good	
20	35	M	Left eye	Ptosis	Poor	Good	Excellent	

Autologous fascia lata used for frontalis sling surgery is considered ideal because it is durable, has excellent tensile strength, easy handling, low complication rate, and success rate of nearly 94%.^{7,8} It can be used in children above 1 year of age as the leg has grown sufficiently to obtain adequate fascia. However, harvesting fascia lata prolongs the overall surgical procedure slightly and causes a linear scar on the lateral side of the thigh.^{9,10}

If there is concern about donor site morbidity, then banked fascia lata or synthetic materials like Mersilene mesh/GORE-TEX/silicon rods can be used because of their inert nature and high-tensile strength.¹¹⁻¹³ The obvious disadvantages of synthetic materials are that they do not integrate with the eyelid tissues and are associated with complications like exposure, chronic inflammation, extrusion, granuloma formation, infection, and recurrence. Many of these cases require surgical intervention for the removal of alloplastic material, skin repair, and control of infection.¹⁴ Long-term success of banked fascia lata decreases to 50% and there is also a risk of cross-infection.¹⁵ Monofilament sutures (polypropylene/nylon) have also been used as slings; however, their breakage rate is very high.^{16,17}

Many patterns are described for fixing suspension sling to the tarsal plate and the frontalis muscle. These, either single or in a pair, are derivatives of three basic patterns: triangular/pentagon/or rectangle. Triangular and pentagon patterns have three point's fixations, whereas in rectangle, there is only two point's fixations. Three point's fixation has the disadvantages of the indirect line of pull, leading to loss of power of frontalis muscle and making sling less efficient, while two point's fixations

have more efficient pull of tarsal plate. Moreover, triangular and pentagon patterns are more complicated, requiring the Wright needle for passage of sling and cause more scarring.^{1,18,19}

A simple design of fixation of the tarsal plate to the frontalis muscle with a double rectangle (open superiorly) made of autologous fascia lata was used in the present study. This method is a modification of technique by Spoor et al.,⁷ but in our technique, suturing of two central limbs of the sling together creates more lifting force in the central part of the eyelid. In this method, two points straight-line fixation transfers the power of frontalis muscle to upper eyelid more effectively. Maximum power is required to lift the center part of the eyelid, and in the technique described by us, the central limb of the sling is a double-strand, giving maximal power to lift the eyelid against gravity and overcome the constricting effect of the orbicularis oculi. It is technically easy and creates a well-balanced upper lid with minimal scarring.

According to principles of Physics, any sling works best when the sling-load angle (SLA-angle between the fascia and tarsal plate) is 90°. ²⁰ Sling's load-bearing capacity decreases as the angle between sling and load (upper eyelid) decrease. The success or the failure (recurrence of ptosis) of frontalis sling surgery can be attributed to material and pattern used for suspension.²¹ As expected, a gradual cumulative strain is placed on suspension sling each time the eye blinks, and fatigue/structural changes occur within the sling material. Fascia lata becomes stiffer and stronger, while synthetic material tends to fray and break. These properties of sling material along with

Table 2 Ptosis recurrence after frontalis suspension with different material

S no	Authors	No. of eyelids	Material used	Pattern used for sling	Follow-up duration (months)	Recurrence rate
1	Crawford ¹	316	Autogenous fascia lata irradiated fascia lata	Double triangle	NA	5% 8%
2	Spoor ⁷	18	Irradiated fascia lata	Double rectangle	4-24	No recurrence reported
3	Mehta ¹²	32	Polyester	Modified Fox pentagon	29	23-25%
4	Esmaili ¹⁵	132	Banked fascia	Crawford's double triangle	128	28%
5	Liu ¹⁶	112	Nylon	Not specified	84	100%
6	Ben Simon ¹⁷	164	Autogenous fascia lata Silicon Nylon, polyester, PTFE	Double pentagon	20	22% 44% 15-36%
7	Wasserman ²¹	102	Banked fascia lata Autogenous fascia Polypropylene, nylon, polyester	Single pentagon	24	51.4% 4% 12-69%
8	Yoon ²⁴	324	Autogenous fascia lata	Single rectangle	18	15.5%
9	Bajaj ²⁵	60	Ethibond Polyester	Crawford's double triangle	16	17% 7%
10	Carter ²⁶	61	Silicon	Fox pentagon	22	7%
11	Wilson ²⁷	112	Banked fascia lata	Two rhomboids	86	43%
12	Wagner ²⁸	145	Autogenous fascia Nylon	Single/double rhomboid	NA	8.3% 40.5%
13	Lee ²⁹	181	Preserved fascia lata Silicon	Pentagonal configuration	36	63.2% 29.2%
14	Kim ³⁰	76	Banked fascia	Single rectangle	106	No recurrence reported poor result in 11.4%
15	Current study	26	Autogenous fascia lata	Double rectangle	12	No recurrence Undercorrection in 2 eyelids

the pattern used for suspension are the two mainstays of long-term outcome after ptosis surgery.^{22,23} ▶ **Table 2**^{1,7,12,15-17,21,24-30} shows a clear relationship between these two attributes and the outcome in the form of a lower incidence of recurrences, with autologous fascia lata sling using the rectangular pattern.

In this study, although there was under correction in 2 eyelids, the levator function was fair in all patients, suggesting that the double rectangle fascia lata sling had a good pulling function on eyelid. When adjusting the tension of sling, it is better to undercorrect, as overcorrection may lead to exposure keratitis. Undercorrection if significant can be corrected by retightening the sling. In the present technique, a two-point direct fixation of the fascia lata to the tarsus and the frontalis muscles achieved predictable and stable results in patients with severe ptosis. Complications like hernia, haematoma, wound dehiscence, or infection following fascia lata harvest was not noticed. A retrospective study involving a small number of patients with a short follow-up of 12 months was the major limitation of the present study.

Conclusion

Frontalis sling with double rectangle pattern using autologous fascia lata is a simple and effective technique for correction of severe ptosis.

Ethical Statement

- Funding: (if any)–nil.
- Conflicts of Interest: None
- Ethical approval: Institutional ethical committee approval taken.
- Informed consent: obtained from patients and their parents in cases of minor

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