Surgical Treatment of Severe Ptosis by Modified Brow Suspension Technique

Le traitement chirurgical d'une ptose marquée par la technique modifiée de suspension des sourcils

Ali Adawal Ali, FICMS¹ , Abdulhameed Abdul Majeed Hassan, FICMS¹, and Marwan Salah Salman, FICMS²

Plastic Surgery
2020, Vol. 28(1) 40-45
© 2019 The Author(s)
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/2292550319880923
journals.sagepub.com/home/psg

Abstract

Background: Blepharoptosis can occur at any age. Its surgical correction may be indicated for functional and cosmetic purposes. Blepharoptosis treatment in children <3 years old may be required on an urgent basis to prevent amblyopia. The type of surgery depends on the severity of ptosis. The purpose of the study is to assess the functional results and complications of frontalis sling operation using double-threaded prolene as a suspensory material to correct severe ptosis with minimal or no levator muscle function. **Methods:** In total, 72 lids of 59 patients (both male and female) having severe unilateral or bilateral ptosis were included. Frontalis sling with double-threaded prolene using cannula for introducing prolene was used to correct severe ptosis in these patients. Patients were followed up for an average of 21 (range: 12-24) months postoperatively for evaluating the functional and cosmetic results as well as possible complications. **Results:** Favourable long-term functional and cosmetic results were achieved in most patients. The overall recurrence rate of ptosis was in 5 lids, most of which were in <5-year-old patients. Other complications were incomplete closure in 2 lids, overcorrection in 1 lid, and corneal exposure and exposure keratitis in 1 eye. Infection, wound problems, and supratarsal sulcus obliteration were not observed in any case during the follow-up period. **Conclusions:** Frontalis sling operation using double-threaded prolene as a suspensory material is an effective technique to correct severe ptosis.

Résumé

Historique: La blépharoptose peut se produire à tout âge. Sa correction chirurgicale peut être indiquée pour des raisons fonctionnelles et esthétiques. Chez les enfants de moins de trois ans, elle peut s'imposer d'urgence pour prévenir une amblyopie. Le type d'intervention dépend de la gravité de la ptose. La présente étude a été réalisée pour évaluer les résultats fonctionnels et les complications d'une chirurgie de suspension frontale à l'aide d'une suture prolène à double aiguillée pour corriger une ptose marquée sans utiliser les muscles releveurs, sinon très peu. **Méthodologie:** Les chercheurs ont inclus dans l'étude 72 paupières de 59 patients (hommes et femmes) présentant une ptose unilatérale ou bilatérale marquée. Une suspension frontale à l'aide d'une suture prolène à double aiguillée a été placée par canule pour corriger une ptose marquée. Ces patients ont été suivis pendant une moyenne de 21 mois (plage de 12 à 24 mois) après l'opération pour évaluer les résultats fonctionnels et esthétiques ainsi que les complications possibles. **Résultats:** La plupart des patients ont obtenu des résultats fonctionnels et esthétiques favorables à long terme. Cinq paupières ont présenté une récurrence, la plupart chez des patients de moins de cinq ans. Les autres complications incluaient deux paupières à la fermeture incomplète, la surcorrection d'une paupière et une kératite par lagophtalmie. Aucun cas d'infection, de problèmes de plaie ou d'oblitération du sillon sus-tarsal n'a été observé pendant la période de suivi. **Conclusions:** La chirurgie de suspension frontale à l'aide d'une suture prolène à double aiguillée est une technique efficace pour corriger une ptose marquée.

¹ Department of Surgery, College of Medicine, Kirkuk University, Kirkuk, Iraq

² Department of Surgery, College of Medicine, Tikrit University, Tikrit, Iraq

Corresponding Author:

Ali Adwal Ali, Department of Surgery, College of Medicine, Kirkuk University, Kirkuk 36001, Iraq.
Email: aliadwal@gmail.com

Keywords

prolene, fascia lata, sling operation, frontalis, suspension, cannula

Background

Upper eyelid ptosis is defined as the drooping of the upper eyelid margin by >1 to 1.5 mm below the superior limbus in the primary position of gaze (ie, with the patient focusing on an object placed at the pupillary level at a distance of 1.5 m).^{1,2} It is unknown when the correction of ptosis was first attempted. The literature states that Celsus described the excision of eyelid skin in the first century AD.³ Such excision was again proposed by Arabian surgeons and subsequently adopted and modified by Scarpa in 1801,³ Hunt in 1830, and others. In the late 19th century, Dransant described the use of absorbable sutures to attach the lid tissues to the brow.⁴ Currently, many surgical techniques are used for correcting ptosis,⁵ and the choice of surgical procedure is mainly determined based on the severity of ptosis and the levator muscle function.⁴ Four main surgical techniques that are commonly used are Muller muscle shortening,⁶ levator muscle resection,¹ levator aponeurosis repair,¹ and brow (frontalis) suspension.^{7,8}

The brow (frontalis) suspension technique is used when the contractile activity of the lid-elevating complex cannot be restored.⁹ This technique involves attaching the tarsal plate to the elevating fibres of the frontalis muscle using an inelastic sling^{3,10} and remains the most effective procedure for treating severe ptosis with poor levator muscle function.⁴ The most common indications for this procedure are as follows^{5,11}: (1) severe ptosis (≤ 4 mm) with poor levator muscle function (≤ 4 mm), (2) Marcus Gunn jaw-winking syndrome, (3) blepharoptosis associated with aberrant regeneration of the third cranial nerve, (4) blepharophimosis syndrome, (5) blepharoptosis associated with third nerve palsy, and (6) unsatisfactory result from previous levator muscle resection.

Over the last century, multiple modifications of the frontalis suspension procedure have been attempted, including the use of skin flaps, muscle slips, fascia lata strips, and a variety of suture materials, such as nylon and, more recently, silicone, mersilene mesh, and Gore-tex.^{4,12} Autologous fascia lata (AFL) is the gold-standard material considered for ptosis correction surgery. Surgeons and patients occasionally prefer nonautologous materials because surgery using these materials can be performed under local anesthesia in adult patients and the second incision can be avoided. Nonautologous materials are also preferred when AFL is not available, for example, in very young children with short legs.¹³

Methods

This study was conducted at Azadi Teaching Hospital in Kirkuk between September 2014 and October 2017 and included 13 patients with bilateral ptosis and 46 with unilateral ptosis. No patient with myasthenia gravis was included in the study. The surgical technique starts with 3 small stab incisions

Figure 1. Diagram showing sites of stab incisions.

Figure 2. The cannula introduced from medial to the central supra-brow incisions.

(2-4 mm long). One was made above the brow and other 2 incisions were made above the eyelashes (Figure 1). A cannula (18 gauge/1.3 mm in diameter/45 mm in length) was used to act as a path for nonabsorbable suture (4-0 prolene) introduction and then the cannula was introduced from the medial supra-brow incision to the central supra-brow incision (Figure 2). Afterwards, the prolene thread was introduced through the cannula following the withdrawal of cannula leaving prolene thread (Figure 3). The cannula was again introduced from the medial pretarsal incision to the medial supra-brow incision through which prolene was introduced in the same way, the cannula withdrawn. Then, the cannula was introduced from lateral pretarsal incision to the medial pretarsal incision and prolene thread was introduced through the cannula

Figure 3. Cannula withdrawn, prolene left in.

Figure 4. The cannula was introduced from lateral to medial pretarsal incisions.

(Figure 4). Then, cannula introduced from the lateral supra-brow incision to the lateral pretarsal incision, prolene introduced (Figure 5). Finally, the cannula was introduced from central supra-brow incision to the lateral supra-brow incision and the prolene thread was introduced (Figure 6). At this point, the 2 ends of prolene thread were withdrawn from the central supra-brow incision. The cannula acts as a path to avoid dissection of the tissue. The procedure was repeated to introduce the second prolene thread. Finally, both threads were tied in a degree that holds the upper eyelid in a near-normal position and the stab wound was closed then. Oral broad-spectrum antibiotics were prescribed for 1 week postoperatively, topical antibiotics and lubricants were used for the first week postoperatively and then as required.

Figure 5. The cannula introduced from lateral supra-brow to lateral pretarsal incisions.

Figure 6. The cannula introduced from the central to the lateral supra-brow incisions.

Results

Fifty-nine patients (72 eyelids) were included in the study, 37 of whom were females and 22 were males. Thirty patients were <5-year-old children, 9 were 5- to 12-year-old children, 15 were 12 to 50 years old, and 5 were >50 years old (Table 1).

All patients had severe ptosis with minimal or no levator function. General anesthesia used for all paediatric age groups (≤ 12 years), whereas local anesthesia was used for age groups older than 12 years. Most of the patients have congenital ptosis, while many of patients have blepharophimosis and chronic progressive external ophthalmoplegia.

All patients were followed up for 12 to 24 (mean: 21) months postoperatively to assess the functional and cosmetic results. For functional assessment, the clarity of the pupillary

Table 1. Demographic Characteristics of the Study Sample.

Age (Years)	Females (n)	Males (n)	Total (n)	Bilateral Ptosis (n)	Unilateral Ptosis (n)	Complications
<5	23	7	30	7	23	Recurrence = 4 Incomplete closure = 2 Corneal closure keratitis = 1
5-12	3	6	9	2	7	Recurrence = 2
12-50	7	8	15	3	12	Recurrence = 1
>50	2	3	5	1	4	Over correction = 1

Figure 7. Patient with severe ptosis showing (A) preoperative condition and (B) 1-year postoperative result. **Figure 8.** Patient with severe ptosis showing (A) preoperative condition and (B) 5-year postoperative result.

axis was evaluated. Cosmetic assessment included the subjective estimation of the examiner and the patient or his or her parents as well as objective comparison with the contralateral side. Preoperative and postoperative results of 2 patients are presented in Figures 7 and 8.

The following complications were reported during the follow-up (Table 1). Incomplete closure was observed in 2

(2.7%) of the 72 lids: static in one lid and dynamic in another. Overcorrection was observed in 1 (1.4%) of the 72 lids. No wound problems, such as scar or granuloma formation, were reported in any case. Supratarsal sulcus obliteration was absent in all cases. Corneal exposure keratitis was observed in 1 (1.4%) of the 72 eyes. No case of infection was reported. Ptosis recurrence occurred in 7 (9.7%) of the 72 lids. Most cases of

recurrence were noted in <5-year-old patients. Such patients subsequently underwent revision surgery.

Discussion

In infancy and early childhood, ptosis surgery is performed on an urgent basis primarily to prevent stimulus deprivation amblyopia.¹² However, in adulthood, the surgery is rarely urgent and may be for a functional or cosmetic purpose. It is known that frontalis/brow suspension procedures are necessary to achieve satisfactory correction of severe ptosis associated with minimal or no levator muscle function.⁹ Although general agreement exists regarding the indications for brow suspension surgery, there is no such consensus for the suspensory material to be used.¹² Many studies have reported that AFL is the best material for brow suspension procedures^{3,11,13-15}; however, fascia lata suspension technique has some disadvantages, for example, the type of anesthesia (must be general anesthesia), the need for a second surgical site, size limit for the leg, procedure length, and association with some risks.^{12,16} Other possible complications include postoperative infections, hematoma, small muscle herniation, weakness of hip flexion, numbness, pain, hemorrhage, superficial phlebitis at or near the fascia donor site, and resultant scar, which may remain long term.¹⁴ Over time, many alternative materials have been used for brow suspension procedures; these can be divided into biological materials and synthetic materials. The biological materials include preserved human fascia, sclera, bovine fascia, skin, and muscle.¹⁶⁻²² The synthetic materials include metal implants,²² Gore-tex bands,²³ and different suturing materials, such as silk, prolene, polyester, and mersilene.¹²⁻²⁴

The ptosis recurrence rate after surgery with double-threaded prolene in our study was 9.7%, which is close to the 8% reported by Kemp et al who used the fascia lata suspension technique.¹⁵ This results in the previous study could be due to the incorporation of fibrous tissue between the fascia lata fibres and the bulkiness of the fascia.¹⁵ Similarly, double-threaded prolene in our study allowed more incorporation of fibrous tissue between the 2 threads, and the resultant fibrous band ensured satisfactory long-term results; further, the use of cannula as a path for introducing prolene with minimum or no dissection must have provided superior results to those obtained by the traditional use of prolene or nylon. In a previous study, using nylon suture thread in a series of 55 patients, Katowitz obtained a high 29% ptosis recurrence rate probably because the nylon thread lacked fibrous tissue incorporation.²⁵ Further, Manner et al recommended the use of prolene as only a temporary procedure, mostly for <3-year-old children with the risk of amblyopia, because the use of prolene is likely to lead to ptosis recurrence.²⁶ They also reported that if prolene is used, the second surgical site and donor site morbidity will be avoided; however, after the fascia lata harvesting technique, the thigh scar may progress to a hypertrophic nature and/or keloid²⁷; herniation of the bulky thigh muscles and infections could occur; and suture marks would remain.^{28,29} For frontalis suspension using scleral sling, a donated eyeball and special

preparatory laboratories are needed, which makes the availability of sclera limited to certain centres.¹⁸

None of the patients in the present study developed supratarsal fold obliteration, which is a considerable aesthetic problem occurring after the fascia lata suspension technique.³⁰ This difference is probably because small-diameter prolene (4-0 prolene) was used in the present study, and the procedure involved the introduction of prolene through a cannula, leading to minimum injury to the tract and, consequently, minimum inflammation in wound healing.

Further, in the present study, the scars at the site of prolene introduction were very small and mostly invisible, and most skin incisions did not need suturing. This was because prolene introduction through a cannula required very small incisions to allow the passage of the cannula, which could be achieved by one pass without any dissection. On the other hand, scars after the fascia lata suspension technique are >3 mm, and most skin incisions need suturing, resulting in evident scars.⁴ This is because this technique involves skin dissection, causing high risk of skin necrosis and extrusion with granuloma formation.^{4,27,31}

In the study by Deenstra et al, all patients undergoing fascia lata sling surgery required general anesthesia,³⁰ whereas in the present study, local anesthesia could be administered in all >12-year-old patients because the procedure was simple involving the introduction of a cannula through premarked tracts for which administration of local anesthesia was sufficient. This finding is important especially for geriatric patients who are sensitive to general anesthesia.

No case of extrusion occurred in the present study, whereas the extrusion rate in the study by Hintschich et al was 13.6%. This difference was probably because, in the present study, no dissection was required for the delicate upper eyelid skin, which reduced the risk of skin necrosis and granuloma formation, and prolene is an inert material with no or minimum tissue reaction.¹²

Moreover, in the present study, revision surgery for ptosis recurrence was required in 6.9% lids, whereas Kemp et al reported revision surgeries in 8% cases.¹⁵ The revision surgery rate was 11.4% in the study by Carter et al who used silicon rods,³² approximately 4.1% in the study by Wasserman et al when using fascia lata,⁴ 50% in the study by Manner et al [The author name "Manner et al" given along with Ref. 26 does not match with the name given in Ref. 26 of the reference list. Please edit as necessary.] who used polypropylene,²⁶ and 69% in the study by Wasserman et al when using nylon.⁴ In the present study, revision surgery was very easy using the cannula as a path for prolene introduction, whereas it is technically demanding in other types of surgeries because the extensive dissection in the first surgery leads to fibrosis, which when redissected during revision surgery may lead to skin necrosis, granuloma, and a long-term evident scar.

Exposure keratitis was observed in 1 patient (one lid, 1.4%) in the present study, whereas in no patient in the study by Lane and Collin.³³ This finding in the present study may be because the patient was not using eye ointments and lubricants routinely as prescribed, which might have led to corneal dryness especially while sleeping.

Conclusion

Frontalis suspension surgery using double threading of prolene and a cannula can be considered as an effective method for treating cases of severe ptosis.

Authors' Note

A.A.A. has conceptualized and designed the study and also was involved in the conduction of the study. A.A.M.H. has written and M.S.S. has conducted the study. All authors have read and approved the manuscript. Consent has been taken from the institution and the patients. Availability of data and material: The data sets used and/or analysed during the current study are available from the corresponding author on reasonable request. Ethical approval has been taken from ethical committee of scientific research. Institution: Kirkuk College of Medicine, Kirkuk University. Committee's references number not applicable. Medical@uokirkuk.edu.iq.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iD

Ali Adawal Ali, FICMS <https://orcid.org/0000-0002-4063-7853>

References

- Vuyk HD, Lohuis PJEM. *Facial Plastic & Surgery*. 1st ed. London, United Kingdom: Edward Arnold; 2006:70.
- Sakol PJ, Manoor G, Massaro BM. Congenital and acquired blepharoptosis. *Curr Opin Ophthalmol*. 1999;10(5):335-339.
- Crawford JS. Repair of ptosis using frontalis muscle and fascia lata: a 20 year review. *Ophthalmic Surg*. 1977;8(4):31-36.
- Wasseman BN, Sprunger DT, Helveston EM. Comparison of materials used in frontalis suspension. *Arch Ophthalmol*. 2001;119(5):687-691.
- El-Toukhy E, Salaem M, El-Shewy E, Abou-Stiet M, Levine M. Mersilene mesh sling as an alternative to autogenous fascia lata in management of ptosis. *Eye*. 2001;15(pt 2):178-182.
- Loff HJ, Wobig JL, Daily RA. Transconjunctival frontalis suspension: a clinical evaluation. *Ophthal Plast Reconstr Surg*. 1999;15(5):349-354.
- Manner RM, Tyers AG, Morris RJ. The use of prolene as a temporary suspensory material for brow suspension in young children. *Eye*. 1994;8(pt 3):346-348.
- Albert DM, Jakobiec FA, Azar DT, Gragoudas ES. *Principles and Practice of Ophthalmology*. 1st ed. Philadelphia, PA: W.B. Saunders company; 2000:3463-3464.
- Dortzbach RK, Levine MR, Angrist RC. *Approach to Acquired Ptosis*. In: Smith BC. *Ophthalmic and Plastic Reconstructive Surgery*. St. Louis, MO: Mosby; 1987:677-680.
- Downes RN, Collin JR. The mersilene mesh sling—a new concept in ptosis surgery. *Br J Ophthalmol*. 1989;73:498-501.
- Collin JRO. *A Manual of Systematic Lid Surgery*. 2nd ed. Edinburgh, United Kingdom: Churchill Livingstone; 1989:61-65.
- Hintschich CR, Zurcher M, Collin JR. Mersilene mesh brow suspension: efficacy and complications. *Br J Ophthalmol*. 1995;79(4):358-361.
- Beyer CK, Albert DM. The use and fate of fascia lata and sclera in ophthalmic plastic and reconstructive surgery. The 1980 Wendell Hughes lecture. *Ophthalmology*. 1981;88(9):869-896.
- Wargner RS, Mauriello JA, Nelson LB, et al. Treatment of congenital ptosis with frontalis suspension: a comparison of suspensory materials. *Ophthalmology*. 1984;91(3):245-248.
- Kemp EG, James CR, Collin JRO. Brow suspension in the management of ptosis: an analysis of over 100 cases. *Trans Ophthalmol Soc U K*. 1986;105(pt 1):84-87.
- Downes RN, Collin JRO. The Mersilene mesh ptosis sling. *Eye*. 1990;4(4 pt 3):456-463.
- Broughton WL, Mathews JG, Harris DJ. Results of treatment using lyophilized fascia lata for frontalis suspensions. *Ophthalmology*. 1982;89(11):1261-1266.
- Bodian M. Repair of ptosis using human sclera. *Am J Ophthalmol*. 1968;65(3):352-358.
- Billet E. Bovine fascia lata in ptosis surgery. *Am J Ophthalmol*. 1968;65(4):561-571.
- Fox SA. A new frontalis skin sling for ptosis. *Am J Ophthalmol*. 1968;65(3):359-362.
- Reese RG. An operation for blepharoptosis with the formation of a fold in the lid. *Arch Ophthalmol*. 1924;53:26-30.
- Duke-Elder S. *System of Ophthalmology*. 1st ed. London: Kimpton; 1974:543-549.
- Adenis JP, Lebraud P, Mathon M. Utilisation du PFTE (Goretex) dans la suspension palpebro-frontale pour le ptosis. *J Fr Ophthalmol*. 1987;10(4):607-609.
- Cole MD, O'Connor GM, Raafai F, Wilshaw HE. A new synthetic material for brow suspension procedure. *Br J Ophthalmol*. 1989;73(1):35-38.
- Katowitz JA. Frontalis suspension in congenital ptosis using a polyfilament cable type suture. *Arch Ophthalmol*. 1979;97(9):1659-1663.
- Mehta P, Patel P, Olver JM. Functional results and complications of Mersilene mesh use for frontalis suspension ptosis surgery. *Br J Ophthalmol*. 2004;88(3):361-364.
- Crawford JS. Fascia lata: its nature and fate after implantation and its use in ophthalmic surgery. *Trans Am Ophthalmol*. 1968;66:673-745.
- Mauriello JA, Abdelsalam A. Effectiveness of homologous cadaveric fascia lata and role of suture fixation to tarsus in frontalis suspension. *Ophthal Plast Reconstr Surg*. 1998;14(2):99-104.
- Wheatcroft SM, Vardy SJ, Tyers AG. Complications of fascia lata harvesting for ptosis surgery. *Br J Ophthalmol*. 1997;81(7):581-583.
- Deenstra W, Melis P, Kon M, Werker P. Correction of severe blepharoptosis. *Ann Plast Surg*. 1996;36(4):348-353.
- Esmaeli B, Chung H, Pashby RC. Long term results of frontalis suspension using irradiated, banked fascia lata. *Ophthalmic Plast Reconstr Surg*. 1998;14(3):159-163.
- Carter SR, Meecahm WJ, Seiff SR. Silicone frontalis slings for correction of blepharoptosis: indications and efficacy. *Ophthalmology*. 1996;103(4):623-630.
- Lane CM, Collin JRO. Treatment of ptosis in chronic progressive external ophthalmoplegia. *Br J Ophthalmol*. 1987;71(4):290-294.