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Research Article

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Predicting the Success Rate of Levator Resection Surgery Using Whitnall Ligament Position

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Introduction

Ptosis is defined as lower positioning of the upper eyelid margin which normally is placed 1.5 mm below the superior corneal limbus [1]. Ptosis can be accounted as the 3rd most common eyelid disorders following chalazion and entropion [2]. It may result in amblyopia, visual field defect, cosmetic and psychological problems. Generally, ptosis is subdivided to congenital and acquired cases [3]. Abnormal development of levator muscle or innervation abnormalities is responsible for congenital cases of ptosis. On the other side, trauma, several neurologic disease, and defective levator aponeurosis can lead to acquired ptosis [4]. Levator function, clinical feature, and concomitant eyelid or face abnormalities are the determining factors for choosing appropriate surgical plan [5]. Common surgical approaches include frontalis suspension technique and levator muscle procedures (levator advancement and levator resection) in which frontalis suspension is performed in cases with poor levator function and the latter one is suitable for patients with preserved levator function [4]. Levator resection outcomes are not absolutely predictable. Multiple factors such as ptosis severity, levator function, and age of patient have been discussed as predictive factors for surgical success rate.

Functionally Whitnall's ligament is considered as the check ligament of the levator. It seems this ligament is a supportive structure for the upper eyelid and superior orbit. To the best of our knowledge, investigation on association between levator muscle biometric and its aponeurosis and also Whitnall's ligament with surgical success rate and post-operative outcomes is a novel idea which has been not discussed earlier.

Material and Methods

54 patients with unilateral or bilateral congenital ptosis presenting to oculoplastic department of Farabi eye hospital between May 2020 and December 2020 were enrolled in this study. All of the included patients underwent history taking and complete ophthalmic examination including visual acuity measurement, slit-lamp biomicroscopy, funduscopy, evaluation of ocular movements and bell's phenomenon, measuring of vertical height of palpebral fissure, margin reflex distance (MRD), and amount of levator function in millimeter. These measurements were repeated after surgery. Candidate patients underwent levator resection procedure. During the surgery several factors were measured and recorded including distance between Whitnall's ligament and superior margin of tarsus, length of tarsus, and amount of levator resection. It should be mentioned specimen of levator muscle was sent for histopathological evaluations to assess density of fat, muscle, and fibrosis of levator muscle. These measurements were determined by a sterile caliper. Pre-operative and post-operative photographs of patients were taken and recorded while they were looking straight across, down, and up. Post-operative follow-up visits were scheduled for 2 weeks, 1 and 3 months after surgery. It's of note patients with history of trauma, previous ocular surgery, and syndromic or systemic diseases were excluded.

The study was approved by the institutional review board (IRB) of Tehran University of Medical Sciences. All procedures conformed to the tenets of the Declaration of Helsinki. Written informed consent was received from all participants.

Surgical Procedure

Adult cases underwent for topical anesthesia while child cases experience surgery under general anesthesia. Before the surgery, the upper eyelid creases were symmetrically determined and marked with surgical marker. A bipolar cautery was used to control of bleeding. Skin incision was made on the marked line of upper crease followed by elevation of skin flaps from medial to lateral by 2 forceps. Dissection of orbicularis muscle was performed by Westcott scissors from the tarsal plate. Then orbital septum was horizontally opened and the connections between levator aponeurosis and preaponeurotic fat tissues were excided using blunt and sharp dissection. A temporary central fixation suture proximal to the Whitnall's ligament was inserted from the tarsal plate with a 6.0 polyglactin knot to reach the favorable lid height. The eyelid level was checked and if it was not desirable, the temporary knot was untied and new suture was inserted from the upper or lower point of the tarsal plate according to condition. After reaching to desirable lid level 2 additional sutures were placed from in the

medial and lateral of the first suture within a same distance. The redundant levator complex was excised. Finally, the skin was closed by continuous running sutures.

Discussion

Congenital ptosis is characterized by malpositioning of upper eyelid in primary gaze in which vertical distance of the palpebral fissure seems shorter. It is generally non-progressive, unilateral or bilateral, and can be isolated or in complex with other congenital disorders such as congenital fibrosis of the extraocular muscles (CFEOM) and blepharophimosis [1].

Nowadays several surgical techniques are available for ptosis. Levator function, surgeon experience or preference, and severity of disease can affect the choosing of proper technique. Frontalis suspension technique is accepted as treatment of choice for correction of congenital cases of ptosis with poorlevator function, whereas Levator resection is usually done for cases with fair-to-good levator function more than 4 mm [6,7]. Although a variety of formulas have been introduced to determine the amount of levator resection, there is no consensus on these formulas due to unpredictability and inaccuracy [6,8].

Undercorrection or overcorrection is a considerable point in ptosis surgery. Large amount of levator resection may result in shortening of the distance between the tarsus and the Whitnall's ligament as the check ligament of the levator palpebrae superioris muscle leading to eyelid lag and lagophthalmos [9]. The amount of levator resection is dependent on various factors such as pre-operative levator function and ptosis severity. However, accurate prediction of outcome is still difficult [10].

During surgery Whitnall's Ligament is characterized as a landmark at the most superior extent of the aponeurosis. This transverse fibrous white band lied from the medial to the lateral border of the levator aponeurosis immediately behind the superior orbital rim. This landmark may be weak and almost unrecognizable in some cases of congenital ptosis. In some cases of ptosis this structure may be utilized to improve levator efficiency and even used as a sling to support the eyelid at a higher level. Anatomic variability in this structure may contribute to ptosis [11]. Differences in anatomical position of levator aponeurosis and Whitnall's ligament can influence on surgical outcomes. The distance between the insertion of the levator muscle and Whitnall's ligament has been reported 14-20 mm in previous studies [12]. However, standard values for Asians are not available.

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