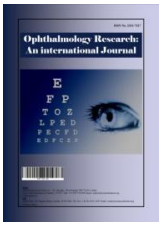

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Management of Conjunctivochalasis

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Conjunctivochalasis is defined as a redundant, nonedematous conjunctiva that causes a wide variety of symptoms. Excess conjunctival tissue may not cause any symptoms and may cause some symptoms like subconjunctival hemorrhage, epiphora, dry eye findings and corneal ulceration. Disturbance of tear meniscus, impaired tear distribution and punctal occlusion play a role in the onset of symptoms.

Although the etiopathogenesis of the disease is not yet clearly understood, several theories have been proposed. According to the mechanical theory, age-related mechanical changes in the conjunctiva lead to a chronic obstruction of the lymphatic flow and lymphatic dilatation after this chronic obstruction leads to conjunctivochalasis. According to inflammatory theory, collagenolytic activity increases as a result of inflammation on the ocular surface, causing degeneration of elastic fibers. As a result, degeneration of elastic fibers lead to alterations in the extracellular components of the conjunctival tissue. This inflammatory changes resulting in conjunctival laxity.

Although conjunctivosalasis (CCh) is a clinical diagnosis, it is often overlooked by clinicians. CCh patients are can be symptomatic or asymptomatic. Medical and / or surgical treatment is generally needed in symptomatic patients, whereas treatment is not necessary in asymptomatic patients. Medical treatment is the first choice in the treatment of conjunctivochalasis. Artificial tear preparations are widely used in the treatment of CCh due to the deterioration of the tear film layer and dry eye symptoms. In clinical practice, topical anti-inflammatory eye drops are often preferred to reduce ocular surface inflammation. In cases where medical treatment is not sufficient, surgical treatment should be performed.

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Today, there are many studies showing that surgical treatment is effective in reducing ocular symptoms and ocular surface damage in patients with CCh and in cases with and without dry eye.The surgical treatment plan should include the loose conjunctival tissue located in the lower part, as well as the excess conjunctival tissue located in the nasal and temporal regions and aim to correct the tear meniscus along the entire lower lid margin. The most preferred surgical method is crescent excision of CCh tissue and primary suture of the conjunctiva. Other surgical approaches include fibrin glue and amniotic membrane transplantation and direct scleral suture of CCh tissue. Another surgical method is electrocauterization of the conjunctival tissue. It is applied 5 mm away from limbus and there is no harm to fornixes.

Keywords: Argon laser; conjunctivochalasis; conjunctivoplasty; epiphora; dry eye; reduntant conjunctiva.

1. INTRODUCTION

The conjunctiva is a mucous membrane that covers the inner part of the eyelids and the anterior part of the eyeball outside the cornea. The palpebral conjunctiva passes through the eyelids onto the bulbus and makes two recesses called fornix in the upper and lower parts. The conjunctiva on the tars is firmly attached to the underlying tissues and does not move [1]. Conjunctivochalasis is defined as a redundant, nonedematous conjunctiva that causes a wide variety of symptoms .Excess conjunctival tissue may not cause any symptoms and may cause some symptoms like subconjunctival hemorrhage, epiphora, dry eye findings and corneal ulceration [2,3]. Disturbance of tear meniscus, impaired tear distribution and punctal occlusion play a role in the onset of symptoms [2]. Although the etiopathogenesis of the disease is not yet clearly understood, several theories have been proposed.

Although conjunctivochalasis (CCh) is a clinical diagnosis, it is often overlooked by clinicians [4]. CCh patients are can be symptomatic or asymptomatic. Medical and / or surgical treatment is generally needed in symptomatic patients, whereas treatment is not necessary in asymptomatic patients. Medical treatment is the first choice in the treatment of conjunctivochalasis [5]. Artificial tear preparations are widely used in the treatment of CCh due to the deterioration of the tear film layer and dry eye symptoms. In clinical practice, topical anti-inflammatory eye drops are often preferred to reduce ocular surface inflammation. In cases where medical treatment is not sufficient, surgical treatment should be performed. The most preferred surgical method is crescent excision of CCh tissue and primary suture of the conjunctiva [6]. Other surgical approaches include fibrin glue and amniotic membrane transplantation and direct scleral suture of CCh tissue [7,8]. Another surgical method is electrocauterization of the conjunctival tissue. It is applied 5 mm away from limbus and there is no harm to fornixes [9,10].

The symptoms of CCh are nonspecific and the onset may be insidious and frequently confused with other oculer surfes diseases. Generally initial symptoms include itching, foreign body sensation, burning, dry eyes and discomfort. Disorder of tear meniscus, impaired tear distribution and punctal occlusion play a role in the onset of symptoms [6]. On the examination, biomiocroscopy shows a prolapse of the conjunctiva over the lower lid margin in temporal, central or nasal regions [Figs. 1,2]. This loose conjunctiva obstructs the lower lacrimal punctum and causes epiphora [Fig. 3].

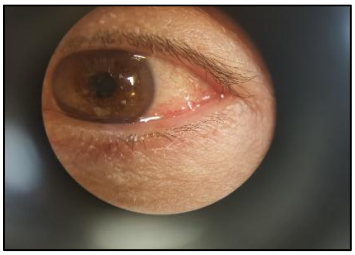

Fig. 1. Prolapse of the conjunctiva over the lower lid margin in temporal region

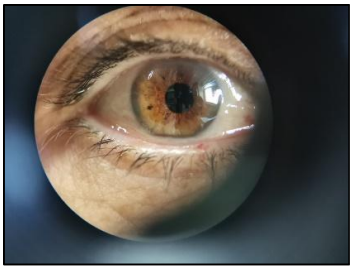

Fig. 2. Prolapse of the conjunctiva over the lower lid margin in temporal, central and nasal region

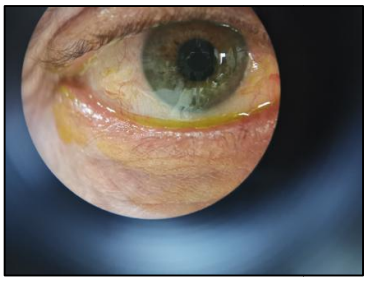

Fig. 3. This loose conjunctiva obstructs the lower lacrimal punctum and causes epiphora

Although the etiopathogenesis of the disease has not yet been clearly understood, several theories have been proposed. According to the mechanical theory, age-related mechanical changes in the conjunctiva lead to a chronic obstruction of the lymphatic flow and lymphatic dilatation after this chronic obstruction leads to conjunctivochalasis [11].

According to inflammatory theory, collagenolytic activity increases as a result of inflammation on the ocular surface, causing degeneration of elastic fibers. As a result, degeneration of elastic fibers lead to alterations in the extracellular components of the conjunctival tissue [8]. This inflammatory changes resulting in conjunctival laxity [12].

Previous studies in which histopathology of CCh was evaluated by light microscopy, stromal lymphangiectasis, stromal edema, disintegration of elastic fibers, elastosis and chronic nongranulamatous inflammation were reported. Electron microscopy revealed that intercellular conjunctival stenosis and concomitant stromal elastin were observed [8]. While there is no need for treatment in the non-symptomatic group in the management of conjunctivosalasis, artificial tears and topical steroid treatment are the medical treatment options in symptomatic cases [13]. Surgical treatment is required in patients who do not respond to medical treatment.

2. CONJUNCTIVOCHALASIS

Definition: Conjunctivochalasis was first described by Braunschweig in 1921 [7]. After Duke - Elder evaluated it as a conjunctival hyperplasia requiring surgical excision or electrocoagulation, Liu et al. in 1986, described this disease as loose, non-edematous excess bulbar conjunctival tissue protruding from the eyelid by entering the globe between the lower eyelid [14].

Symptoms: In CCh patients, loose conjunctival tissue may not cause any symptoms, but excess conjunctival tissue may cause some symptoms by causing friction on conjunctival surface or between conjunctiva and cornea [2]. Blurred vision, watering, pain, stinging, burning, foreign body sensation, such as complaints of loose conjunctival tissue contributes to disrupt the tear meniscus [9].

In these patients, the tear distribution on the ocular surface is disrupted, although Schirmer test and tear break up time measurements show that there is no lack of quality and quantity of tears, dry eye-like symptoms may occur.

Increased symptoms such as pain and blurred vision may be associated with increased conjunctival folds on the lower eyelid edge during activities that require prolonged stay in the downward position, such as reading [15]. In a study comparing dry eye with CCh cases without aqueous tear deficiency and CCh cases in terms of ocular surface symptoms, it was found that the symptoms increased in the later hours of the day in patients with dry eye [16], while the other group patients stated that they woke up and had more dryness during the reading.Increased inflammatory cytokines in tears due to decreased tear clearance during sleep have been thought to be the cause of symptoms that become evident when awakened [17].

2.1 Etiopathogenesis and Histopatho-logical Changes

Today, the etiology of CCh has not been fully elucidated. It is thought to be due to the aging of elastic structures and supporting tissues in the conjunctiva. Mechanical friction of the lids to the conjunctiva, conjunctival trauma and abnormal eyelids are accused [14]. Some investigators have suggested that the addition of some inflammatory processes to age-related changes in the structure of conjunctival tissue plays a role in the pathogenesis of the disease. [14,18] While the mechanical effect of the eyelids caused by the clipping movement contributes to these structural changes, local trauma, ultraviolet radiation and delayed tear clearance can accelerate the inflammatory process [19,20,21].

Almeida et al. in their cohort study, investigated the relationship between autoimmune thyroid diseases and CCh, and concluded that autoimmune thyroid disease was a predisposing risk factor for CCh [22].

Although most of the patients with chronic disease suffer from irritations, there are also researchers who suggest that dry eye plays an important role in the etiology [23]. It has been argued that dryness of the ocular surface increases the mechanical effect of the eyelids on the conjunctiva and the amount of inflammation mediators released [9].

Hoh et al. concluded that CCh contributes to the development of dry eye, the clinical and physiopathological role of conjunctivochalasis in dry eye disease due to aqueous tear insufficiency is not clearly known [10,24,25].

Francis et al. showed that 7 of 29 specimens had pathological changes, as 4 specimens showed inflammatory infiltrate and 3 specimen showed elastosis. They think etiology of conjunctivochalasis is multifactorial like UV radiation and trauma [7].

Harbiyeli II et al. showed mechanical and inflammatory factors induce development of CCh, and signs associated with these factors can be detected with light and electron microscopy of conjunctival tissue [26].

Kalin et al. in 7 patients with whom they could not find any other reason, CCh was named as “chronic localized conjunctival chemosis’’ [27].

Kheirkhah et al. in their study in the upper location CCh cases, upper bulbar conjunctival slack in the conjunctival tissue is not due to the excess of the conjunctival tissue, depending on insufficient function of the conjunctiva and sclera caused by the loss of adhesion suggested that this situation [28].

There are two main theories about the mechanism that causes conjunctival tissue changes in the development of CCh [9]. One of them is the mechanical theory which argues that chronic obstruction caused by age-related mechanical changes in the conjunctival tissue plays the most important role in the pathophysiology of the disease, while the other is the extracellular matrix destruction mediated by tear cytokines mediated by increased tear cytokines due to delayed tear clearance [29].

2.2 Inflammatory Theory

Inflammation of the ocular surface [30] in CCh is manifested by inflammatory cell infiltration in the conjunctival epithelium and stroma. Increased collagenolytic activity and degeneration of elastic fibers are changes in the extracellular components of the conjunctival tissue [5]. Ocular surface inflammation has been suggested to play a role in the development of this degenerative process. It is thought that high inflammatory cytokines in the tears are released from the conjunctival epithelium or from the endothelium in the conjunctival vessels due to blinking and ocular movements and trauma to the loose conjunctiva [12].

Clogging of the tear meniscus and punctum with excess conjunctival tissue causes delayed tear clearance. Delayed tear clearance increases the amount of cytokines in tears [10].

Elevated levels of TNF-Alpha, IL-1, IL-6, IL-8 and IL-12 lead to increased levels of matrix metalloproteinase (MMP) involved in conjunctival epithelial and stromal connective tissue degradation and restructuring. The inflammatory response caused by elevated metalloproteinase levels, particularly MMP 3 and MMP 9, results in conjunctival elastosis. The role of increased oxidative stress due to insufficient function of antioxidant enzymes is known in age-related dry eye syndrome and skin aging. In a study on the role of oxidative stress in conjunctivochalasis, 8-hydroxy-2-deoxyguanosine (8-OHdG) showing oxidative stress-related DNA damage and N-hexanoyl-lysine (HEL) levels were evaluated as oxidative stress markers. In conjunctival samples, the number of conjunctival cells positively stained with N-hexanoyl-lysine and 8-hydroxy-2-deoxyguanosine and the HEL levels measured in tears were higher in the conjunctivosalasis group than in the control group, [31] increased oxidative stress in etiopathogenesis [32].

Acera A et al. find concentration of pro-MMP-9 was significantly higher in the conjunctivochalasis eyes than in the healthy controls in their study [33].

Zhang XR et al. demonstrated the lamina propria of the bulbar conjunctiva mildly chronic inflammatory changes accompanied by a large number of lymphangiectasia who has conjunctivochalasis. They suggested bulbar conjunctival lymphangiectasia may be one of the reasons for the conjunctivochalasis [8].

Jia YL et al. investigated the potential role of MAPK signaling pathways in conjunctivochalasis (CCH). They showed that the expression of p-

ERK, p-JNK, and p-p38 in CCH conjunctiva was significantly higher than that in control group. The expression of p38 MAPK, JNK, and ERK proteins in CCH fibroblasts was significantly higher than that in control group. The total expression of MAPK mRNA in CCH fibroblasts was significantly higher than that in control group. The activated forms of p38 MAPK, JNK, and ERK proteins and mRNAs might up-regulate the expression of MMPs in CCH loose conjunctival tissue and fibroblasts, causing the degradation of collagen fibers and elastic fibers and promoting the occurrence of CCH [34].

Li et al. showed that overexpression of MMP-1 and MMP-3 mRNA by conjunctivochalasis fibroblasts is correlated with their increased protein levels and proteolytic activities. They claim that increase of this mediatore can explain how conjunctivochalasis manifests excessive degradation of the conjunctival matrix and Tenon's capsule [19,21].

Gan JY et al. reported that the degradation of elastic fibers is one of the histopathological features of the disease. Abnormal elastic fibers were found in the majority of the factors related to the pathogenesis of CCh. They thought that abnormal elastic fibers caused conjunctival relaxation. As a result, they assumed that elastic fibers play an important role in the pathogenesis of CCh [35,36].

2.3 Mechanical Theory

Another factor that plays a role in the development of CCh is age-related degenerative structural changes in the conjunctiva [29]. In addition to studies suggesting that inflammatory changes occurring in conjunctival epithelium and stroma lead to loose conjunctival tissue formation, there are also researchers who hypothesize that histopathological changes are only associated with conjunctival stroma and protect the structure of conjunctival epithelium [37].

Watanabe et al. 44 patients were examined histologically. They found 39 patients had microscopic lymphectectasis. In all cases, elastic fiber disintegration and sparse collagen fibers were seen. They claimed that mechanical forces between the lower lid and conjunctiva gradually interfered with lymphatic flow. Chronic, prolonged mechanical obstruction of the lymphatic flow may cause lymphatic dilatation and finally lead to clinical conjunctivochalasis [12,21].

Poh S et al. showed that meibomian gland dysfunction and female gender were associated with lower tear meniscus area, while older age was associated with increased severity of CCh [38].

Hasemi et al. obtained biopsies from the bulbar conjunctiva of 27 patients with CCh and 16 healthy subjects. They found no significant difference in histopathological features (infiltration of inflammatory cells, fibrosis, lymphangiectasia) between two groups. They suggested the primary pathology of CCh may not be within the conjunctiva itself. Instead, loose ligation of the conjunctiva to the sclera may be the cause of excessive folds in the bulbar conjunctiva [39,40].

It has been suggested that these changes occur as a result of mechanical forces between the lower eyelid and the conjunctiva [21] disrupting the lymphatic flow in the conjunctiva with advancing age [6].

2.4 Clinical Findings

Conjunctivochalasis is usually detected bilaterally by the presence of excess conjunctival tissue located nasally, centrally or temporally around the lower eyelid [10].

Depending on the amount of loose conjunctival tissue, conjunctival folds may be remarkable at first glance, and in some cases it may be necessary to push the conjunctiva over the eyelid to see the folds. On examination, decreased tear break time, corneal and conjunctival staining, delayed tear clearance, eyelid edge erosions, impaired tear meniscus, punctum blistering, subconjunctival haemorrhage are among the findings [7]. Pinguecula and loose eyelid syndrome are other ocular findings that can be seen in patients with conjunctivochalasis.

In the mild form of the disease, degradation of tear film layers by the effect of tear meniscus, [31] while the tear clearance decreases in the next stage. In more serious forms of the disease, conjunctival dryness may be seen due to external exposure of the dellen formation and the conjunctiva overhanging the eyelid edge due to tear dispersion [13].

Loose conjunctival tissue accumulates at the edge of the lower eyelid, disrupting the tear meniscus and adversely affects tear dispersion. In addition, this excess in the conjunctival tissue

causes inflammation at the eyelid edge due to its mechanical effect. Inflammation of the eyelid margin causes meibomian gland dysfunction and the lipid layer of the tear [10]. The reduced tear break up time detected in these patients can be attributed to these changes in tear content and distribution. Corneal and conjunctival staining is another clinical finding related to tear content and distribution in the distribution [8,9]. Cornea as well as conjunctival tissue folds can be shown to be stained by fluorescein and Rose-Bengal dyes.

In a study investigating the effect of tear inflammatory cytokines on ocular surface findings in conjunctivochalasis patients, the amount of inflammatory cytokine in tears was shown to be associated with corneal epithelial damage and corneal staining [8].

Injury of the conjunctival epithelium, meibomian gland dysfunction as well as the friction effect caused by pinching between the eyeball and the lower eyelid. In addition to the deterioration of the tear meniscus, anatomical changes in the punctum also play a role in mechanically reducing the transition of the tear to the canalicular system [10]. Another reason for the tear overflow in these patients is that insufficient meibum does not show an effective lipid barrier function. Delayed tear clearance can be detected in these patients, where the complaint of watering is in the foreground.

Variable localization of loose conjunctival tissue on the sclera allows subconjunctival vessels to easily rupture by rubbing or blinking the eye. Another cause of subconjunctival hemorrhage is increased oxidative stress related vasculopathy [8].

Francis et al. emphasized that there were no ocular findings such as conjunctival staining, eyelid edge erosion, punctum swelling, subconjunctival hemorrhage in conjunctivochalasis patients with irrigated complaints, they suggested that these findings were related to drying on the ocular surface [7].

Although CCh is frequently seen in the temporal conjunctival tissue of the lower eyelid, it can also be seen in the nasal and upper conjunctival tissues. Loose and excess conjunctival tissue in the upper bulbar conjunctiva may cause a clinical picture similar to superior limbic keratoconjunctivitis (SLK). Although the relationship between SLK and CCh has been emphasized in some studies, the pathological significance of this relationship is still unclear [41]. The loose upper bulbar conjunctiva, a characteristic clinical manifestation of SLK, has been proposed as evidence supporting the theory of mechanical friction in the pathogenesis of SLK, as in CCh [42].

Cases with CCh located nasally are characterized by different effects of loose conjunctival tissue on punctum and tear drainage mechanism.

2.5 Diagnosis

Although CCh not a rare disease, it is one of the most commonly misdiagnosed ocular surface diseases. The nonspecific symptoms of the disease often cause misdiagnosis. Because of the different findings during the disease, several examinations may be necessary to make the correct diagnosis. The most common and first complaint of the patients is epiphora due to occluded puncta. CCh is diagnosed clinically and usually does not require testing. Biomicroscopy shows prolapse conjunctival folds in the nasal, temporal or central part of the lower lid margin. The presence of a reduntand conjuctiva on the lower lid, shortening of the tear film break up time (BUT), epiphora indicate CCh. Prolonged epiphora leads to deterioration of the inferior lacrimal punctum [21].

Differential diagnosis can be difficult because there are common symptoms and signs with many diseases. Patients with ocular surface disease often complain of chronic irritation; However, those with CCh suffer from pain in the affected area. Conjunctival chemosis may often be confused with CCh. Consider CCh as a diagnosis if patients with conjunctival chemosis do not have sufficient clinical response to anti-inflammatory and antihistamines.

Diagnosis of CCh is mainly clinical but also some medical device can be used. Gumus K et al. showed that the AS-OCT is a useful and reproducible instrument to measure the cross-sectional area of conjunctiva prolapsing into the tear meniscus of patients with conjunctivochalasis. The method can monitor effectiveness of thermoreduction of CCh [43].

2.6 Differential Diagnosis

Conjunctivochalasis and dry eye syndrome (DES) due to aqueous tear insufficiency can be confused both due to the similarity of the

symptoms and the common clinical findings. Symptoms in DES worsen later in the day, while CCh in the morning becomes more pronounced or unchanged during the day. In DES, subjective complaints increase in upward position, while CCh increases symptoms in downward position.

With the blink movement and the tear film covering the corneal surface, a feeling of relaxation is seen in DES, while the mechanical effects and folds applied to the loose conjunctiva by blink increase the symptoms in patients with CCh. While subconjunctival hemorrhage may be seen in CCh due to the fragile conjunctival vessels in the loose conjunctival tissue, it is not an unusual finding in DES. Fluorescein staining pattern was accompanied by a continuous shallow tear meniscus in DES, while tear meniscus was interrupted or wiped by excess conjunctival tissue in CCh. Tear clearance was found to be normal or delayed in DES, whereas it was often delayed in CCh. Punctum occlusion increases the tear meniscus and tear ocular surface time and improves symptoms in DES, while the increase in the amount of inflammatory cytokines in tears and exacerbation of epiphora causes an adverse effect. Other diseases that may be considered in the differential diagnosis include conjunctival tumors, trichiasis, entropion and ectropion [42,44]. Diagnosis of these diseases can be made easily by careful examination including eyelids.

3. MANAGEMENT AND TREATMENT

Treatment should be specific to the patient's signs and symptoms. If the patient is asymptomatic there is no need to treat. Patient can be followed up periodically before the treatment is started for progression findings. Treatment options in symptomatic patients are divided into two as medical and surgical treatment. Firstly, medical treatment options should be considered and surgical procedures should be applied in cases with no response [21].

3.1 Medical Treatment

Symptoms of CCh are caused by a significant deterioration of the tear meniscus and compression of the loose conjunctival tissue between the globe and the lower eyelid. Artificial tear and lubricant gel treatment can provide partial relief both by regenerating the deteriorating tear film layer and by reducing the frictional complaints associated with lubricant effect [3,29,45].

Increased inflammation on the ocular surface is blamed in the etiopathogenesis of the disease and its reduction should be one of the goals of treatment in symptomatic patients [19]. Low-dose topical steroids, topical anti-inflammatory agents, and cyclosporine A can be used to both prevent progression and reduce existing complaints [19,28]. However, other anterior segment problems associated with cch should be treated. (blepharitis, allergic conjunctivitis, dry eye, etc.) [46].

3.2 Surgical Treatment

Today, there are many studies showing that surgical treatment is effective in reducing ocular symptoms and ocular surface damage in patients with conjunctivochalasis and in cases with and without dry eye [5,29,47].

Surgical treatment of CCh patients with tear film defects is positive. In the traditional approach, punktal occlusion is considered as the first choice in patients with conjunctivochalasis who have dry eye and medical treatment is inadequate. In some recent studies, it has been reported that CCh surgery is the first-line treatment option [47].

The surgical treatment plan should include the loose conjunctival tissue located in the lower part, as well as the excess conjunctival tissue located in the nasal and temporal regions and aim to correct the tear meniscus along the entire lower lid margin. Some studies have reported the inclusion of pinguecula into the excised conjunctival tissue in the presence of inflamed pinguecula associated with CCh [13].

It has been shown in many studies that surgical treatment is effective in reducing ocular symptoms and ocular surface damage in patients with non-responsive medical treatment. [5,29,47]

Nowadays, there are several different surgical techniques to treat CCh. Some of these surgical techniques require operating room conditions, while others require outpatient clinic. Dr. Hughes performed the first known conjunctivochalasis surgery [48]. Hughes closed the conjunctival incision with continuous suture after cutting the conjunctiva. However, he described the fixation of the conjunctiva to the sclera with a 6-0 Vicryl suture [49]. In addition to surgical excision of the conjunctiva, the local conjunctiva is produced by electrocoagulation method and this method

allows the conjunctiva to be firmly attached to the Tenon capsule [22]. Surgical techniques mentioned in the literature are listed below.

3.3 Cautery Treatment

One of the surgical methods is electrocoagulation. A type of thermally induced shrinkage or excision that is avoid unnecessary conjunctival folds in the lower lid. It is easy to apply and can be done in outpatient conditions also increases its popularity. With this method, local inflammation of the conjunctiva is created. As a result the conjunctiva is firmly attached to the Tenon capsule [4].

Subconjunctival electrocoagulation was performed using a fine needle electrode placed under the loose conjunctival tissue removed by forceps in a study using high frequency radiod wave. In this method, the power of the radiofrequency generator was adjusted to allow the conjunctival tissues to contract without burning and 10-20 subconjunctival coagulations were performed in the horizontal plane. In severe cases, vertical coagulation was added. During the application, care was taken not to cauterize the vascular structures adjacent to the limbus and the procedure was terminated when the surgeon decided that there was no loose conjunctival tissue. Advantages of the technique over other methods; good surgical control, minimal scar formation, better wound healing and better cosmetic outcome. Youm et al. said that there were no serious cicatricial complications after electrocautery application and conjunctival inflammation in the membrane [2].

Trivli A. et al. said that CCh treatment with radiofrequencies seems to be a safe, short-term and useful surgical technique. The operation time is very short and can be performed in places like outpatient clinics that do not require much equipment [48].

Nakasato S et al. showed that thermocautery is a simple and effective treatment for symptomatic inferior CCh [50].

Chan TC et al. showed that superficial conjunctival cauterization is an effective technique for management of conjunctivochalasis in the short term. An increase in tear film lipid layer thickness along with a decrease in corneal thickness and volume were observed after surgical correction of CCh [51].

Kim KH et al. showed that electrocauterization for conjunctivoplasty can be advantageous in terms of inflammation compared with simple suturing and excision [52].

Jiang LH et al. showed that conjunctivochalasis line bipolar coagulation and removal of loose conjunctiva crescent with considerable effect, bipolar coagulation was significantly shorter operative time, a significant reduction in postoperative complications, surgical procedures easier [53].

Haefliger IO et al. showed that gentle superficial cauterization of the inferior bulbar conjunctiva can induced significant reduction of a moderate conjunctivochalasis [54].

3.4 Argon Laser Treatment

Argon laser has been used for the treatment of many eye-related diseases as well as to shrink the redundant conjunctiva [55].

Choi S. et al. treated with argon green laser of 29 eyes of 18 patients with CCh. They argue that the results of the study are clinically significant, and this method is a simple, effective and easily applicable method, especially in mild and moderate CCh [4].

Yang J et al. used near-infrared laser thermal energy for conjunctivoplasty .In their study a fold of loose conjunctiva is grasped by a pair of forceps. The laser light is delivered through an optical fiber and a laser line is aimed exactly on the conjunctival fold by a cylindrical lens. *Ex vivo* experiments using porcine eye was performed to investigate the induced shrinkage of conjunctiva and decide the optimal laser parameters. They found that up to 45% of conjunctiva shrinkage could be achieved [56].

3.5 Incisional/glue Approaches

3.5.1 Cresent resection and primary suture

This technique described by Braunschweig involves crescent excision of the lower bulbar conjunctiva at a distance of 5 mm from the limbus and incorporation of the remaining conjunctival tissues with suturing [54].

Petris CK et al. supported that conjunctivoplasty using a simple medial conjunctival resection is an effective treatment for patients with epiphora secondary to conjunctivochalasis [55].

Wang X et al. evaluated the efficacy of two surgical methods (simple resection method, and resection and fixation method) for CCh. They found the recurrence rate of conjunctivochalasis was 6/16 in the simple resection group and 1/17 in the resection and fixation group on month 6 after operation, and there was significant difference (P = 0.039). They said that both conjunctival resection and conjunctival resection with sclera fixation can effectively improve symptoms, but the latter 'resection and fixation method' has a lower recurrence rate [57].

3.5.2 Combined resection with radial relaxing incision and lower peritomy

Serrano and Mora modified this technique in order to prevent postoperative complications such as scar tissue and lower conjunctival fornix retraction of the technique described by Braunschweig [58]. This modification involves the excision of the loose conjunctiva with two relaxant radial incisions [13,58].

Wang et al. performed a corneal limbus-based conjunctival semiperitomy. Subsequently, they applied cauterization to the subconjunctival area. They claimed that conjunctival semiperitomy combined with subconjunctival cauterization is a clinically relevant surgical technique for CCh. Because both the redundant conjunctiva and the corneal limbus re-establish the anatomical tight adhesion between the underlying sclera [59].

3.5.3 Conjunctival excision, episcleral fixation and amniotic membrane transplantation with fibrin adhesive

It has been shown in many studies that the amnion membrane can be used effectively in the repair of conjunctival surface after conjunctival tissue excision in CCh surgery [13,28,60].

Fixation of the amniotic membrane to the scleral surface can be accomplished by suturing or the use of tissue adhesives. The use of suture has many disadvantages, such as prolonged surgical time, reduced patient comfort in the early postoperative period, and the incidence of suture related complications (abscess, granuloma formation, development of giant papillary conjunctivitis). Therefore, as in other ocular surface surgery, the use of fibrin-based tissue adhesives has become widespread in CCh surgery [28].

In a retrospective study, Tseng et al. demonstrated that surgical repair of conjunctivochalasis and deepening of the lower fornix provided better clinical results than excision alone. Tseng describes the normalization of the fornix during the removal of the conjunctiva by allowing the loose inferior bulbar conjunctiva to perform a crescent excision beginning with a peritomy about 2 mm posterior to the limbus. The bare scleral defect is then covered with frozen amniotic membrane and secured using sutures [61] or fibrin glue [62].

In this surgical technique, conjunctival peritomy was performed in the lower conjunctiva at 1-2 mm distance from the limbus and excess conjunctival tissue was excised. Then, the appropriate sized amniotic membrane laying on the sclera with the stromal surface facing downwards was folded over itself and fibrinogen solution was dropped onto the stromal surface of the membrane. Following administration of thrombin solution to the scleral surface, the folded half of the amniotic membrane was laid on the scleral surface. The same procedure was repeated for the other half of the amniotic membrane and bare sclera, allowing the membrane to be laid smoothly on the scleral surface [62].

In this technique, the fixation of conjunctival tissue adjacent to the fornix with 8-0 or 10-0 polyglactin sutures can be added to the sclera to prevent the recession of the conjunctiva remaining distal to the excised conjunctival tissue.

3.5.4 Conjunctival excision and amniotic membrane transplantation with suture

In this technique, the bare scleral area was covered with amniotic membrane after crescent excision from the lower conjunctiva at a distance of 2 mm to the limbus and fixed with 9-0 and 10-0 nylon sutures passing through the episclera to the membrane conjunctival edges. During fixation of the amniotic membrane on the scleral surface, care was taken to ensure that it was laid smoothly [13].

3.5.5 Conjunctival excision and closure of tissue adhesive

Looser conjunctival tissue was excised by two radial incisions to the medial and lateral cantus following a peritomy of 180 degrees of the lower conjunctiva. Using tissue adhesive, conjunctival wound lips were joined and conjunctival integrity was achieved [63].

3.5.6 Strengthening of conjunctival adhesion on sclera with amniotic membrane

It is thought that the underlying pathology is not an excess of conjunctival tissue in upper pathogenesis of CCh and loss of adhesion between conjunctiva and sclera causes a loose appearance in conjunctiva [28]. For this reason, the surgical technique to be applied in cases with upper-located CCh should be aimed at increasing the adhesion between the conjunctiva and sclera rather than excising the conjunctiva.

Kheirkah et al. in the surgical technique applied to the upper-located CCh cases, they excised the weak tenon tissue after conjunctival peritomy performed between 10 and 2 hours at a distance of 5 mm from the limbus, then covered the amniotic membrane with the sclera and stabilized with fibrin glue or suture. The conjunctival flap covered on the amniotic membrane is also attached to the amniotic membrane by tissue adhesive or suture. With this method, adhesion between the conjunctiva and sclera was strengthened without excision of the conjunctival tissue, preventing the loose upper bulbar conjunctival tissue from sagging on the cornea [28]. In the study, it was reported that there was no significant difference between the patient group who underwent suturing and tissue glue in terms of both symptoms and signs in the postoperative period [28].

Santiago E et al. evaluated the outcomes of paste-pinch-cut conjunctivoplasty and cautery conjunctivoplasty for the treatment of symptomatic CCh. They found paste-pinch-cut and thermal cautery conjunctivoplasty are both safe and effective surgical treatments for the repair of conjunctivochalasis, with patients reporting greater improvement in symptoms after the cautery technique [4,64].

Doss LR et al. using subconjunctival injection of fibrin sealant followed by conjunctival resection. They received 139 eyes of 70 patients with conjunctivosalasis who did not respond to medical treatment. They have achieved 90% clinical success with the paste, pinch and cut method they have defined [4,65].

Otaka I et al. showed that they treated conjunctivochalasis with conjunctival fixation to sclera, which strongly suggests that conjuctival folds are caused by the folding and the elevating of loosely adherent bulbar conjunctiva of the lower eyelid [61,66].

4. CONCLUSION

Conjunctivochalasis is a common disease especially in the elderly and may cause ocular surface complaints especially in the advanced stages. Patients with ocular surface complaints should receive a good history and a detailed ophthalmologic examination. Since there are many diseases that may cause similar ocular surface complaints, conjunctivochalasis is one of the preliminary diagnoses that comes to mind during the examination and it is very important for the diagnosis. When medical treatment is not sufficient, surgical methods should be applied. Although most of the methods used in CCh surgery are successful, the most appropriate surgery should be chosen for the patient.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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