

Four-layer technique for tracheostomy scar treatment

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One important complication of the tracheostomy procedure is the depressed scar left after the tube is removed. A depressed tracheostomy scar can be aesthetically and functionally unacceptable. Tracheostomy scar treatment aims to fill lost soft tissue volume and correct tracheal skin tug. There are various techniques described to manage post-tracheostomy scars, including the use of autologous tissue or allogenic material and the creation of muscle flaps. In this article, the authors introduce a surgical method using four layers: the scar, the strap muscles, the platysma muscle, and the skin. This procedure has been used in two patients with depressed scar after prolonged tracheostomy placement. The tracheal tug was eliminated in each patient, and an imperceptible cutaneous scar remained. In each case, patient satisfaction was complete. The authors recommend this technique as a simple and effective method of closure for these troublesome tracheostomy scars.

Keywords: Cicatrix / Neck muscles / Tracheostomy

INTRODUCTION

Tracheostomy is a life-saving maneuver used in respiratory emergencies. Securing a reliable airway is an important goal for medical staff; however, this procedure can lead to innumerable unwanted sequelae [1-3]. One complication that is not life-threatening but can leave a lasting mark is the scar left after the airway is removed, particularly if the scar is depressed [4]. Generally, uncomplicated surgical airways are removed, and the lumen is left to heal by secondary intention. There is no approximation of each tissue plane, so a noticeable depressed scar almost always results. During the healing process, fibrosis can cause the skin and subdermal layer contraction, forming a “tra-

cheal tug,” termed skin movement in conjunction with the trachea [5]. In the presence of tracheal tug, patients often complain about difficulty swallowing, discomfort with neck movement, unsightly appearance of the mobile scar, and emotional stress [6-8]. The goals of tracheostomy scar revision are filling the depressed area, providing easy sliding of skin over the trachea, and modifying the scar to relocate it on loose skin lines without tightness [6]. Various methods for correcting post-tracheostomy scars have been described previously, from simple to complex repair techniques. The purpose of this article is to present our four layers, including the de-epithelialized scar, the strap muscles, the platysma muscle, and the skin, technique for the correction of tracheal tug and depressed scar.

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IDEA

Poulard was the first to describe the correction of tracheostomy scars by filling the defect with the de-epithelialized scar [9]. Lewin and Keunen [2] modified this method by shaping the scar into a tube and placing it into the defect. Other methods

have been described, including mobilization of the sternocleidomastoid muscle into a depressed defect and advancement of the platysma muscle [10]. Kulber and Passy [3] described a simple method of isolating the strap muscles and suturing them in the midline. Aitken and Hammond [10] presented a method using the strap and platysma muscles: the double-muscle flap. Carlson et al. [8] suggested using acellular dermal grafts as an interpositional layer over the muscle to prevent re-adherence of the overlying skin.

These reconstruction methods have the following four principles: (1) approximation of individual layers of the neck; (2) filling of tissue deficit, using scar de-epithelialization, muscle flaps, or acellular dermal grafts; (3) excision of scar tissue; and (4) horizontal wound closure, using simple closure or local skin flaps [5]. Following the principles, we benchmarked the previously described surgical techniques and innovated a new four-layer method.

Operative procedure

In the supine position, the patient is administered a local anesthetic containing 2% lidocaine with 1:100,000 epinephrine after marking two separate skin incision lines. One of the two-incision lines is designed to include the depressed scar. The other incision line is an elliptical shape in the transverse direction

along the relaxed skin tension line, large enough to include the first incision line. The area with the scar is de-epithelialized after incising around the depression (Fig. 1A and B). The circumcised island, containing the dermal layer and cicatricial tissue, is tubed by both sides of the de-epithelialized cicatricial island rolled up and sutured with 4-0 Vicryl (Fig. 1C). The second transverse elliptical incision is created in the neck folds and deepened to the platysma muscle. The dissection is carried through subcutaneous tissues, and all the remaining scar tissue is released and excised with excess skin. Then, further dissection is performed below the platysma muscle bilaterally to expose the strap muscles. With proper retraction of the platysma muscle, the strap muscles are separated from the tracheostomy scar and tracheal rings using blunt scissors; thus, these muscles can be moved freely (Fig. 1D). The strap muscles are approximated in the midline, over the tubed scar island, and sutured to each other with 3-0 Vicryl (Fig. 1E). Next, the medial edges of the platysma are brought together over the strap muscles flap and scar flap and sutured with 3-0 Vicryl (Fig. 1F). Superior and inferior cutaneous flaps are elevated above the sutured double-layer muscle flap. Last, the undermined skin flaps are advanced and sutured with 5-0 nylon (Fig. 2).

We applied this surgical method to two patients with tracheostomy scar, and the tracheal tugs were completely eliminated

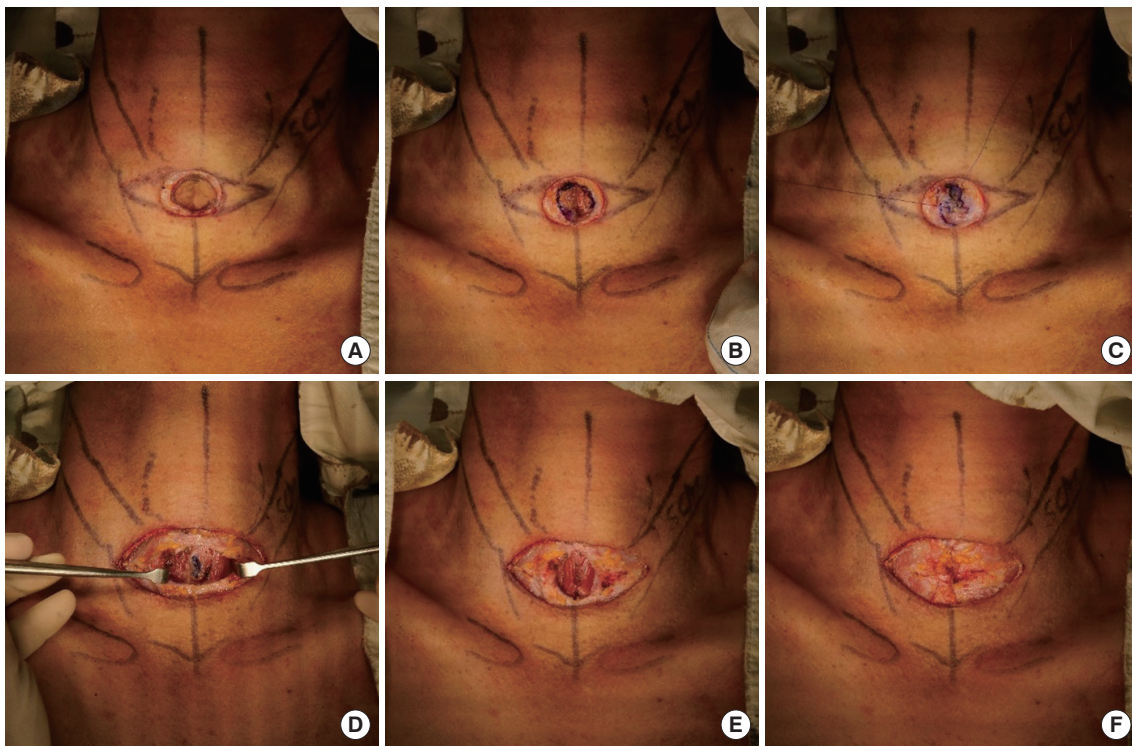


Fig. 1. (A) A 51-year-old man with depressed scar and tracheal tug; incision around depressed scar. (B) De-epithelialization of the cicatricial island. (C) Tubing of the cicatricial island. (D) Dissection below the platysma muscle. (E) Approximation of the strap muscles in the midline. (F) The platysma muscle suture over the strap muscles.

immediately after surgery. After removing the suture materials, taping therapy using Steri-Strips was performed for 2 weeks, and the patients were asked to apply silicone gel ointment and sunscreen for 6 months after that therapy. During 6 months of observations, the postoperative scars were much more acceptable without any widening or deepening (Fig. 3). There was no evidence of the tracheal tug or depressed scar recurrences and no symptom associated with recurrences, such as dysphagia, pain, and bad appearance. Each patient was satisfied with both the aesthetic and functional results.

DISCUSSION

Although tracheostomy is a life-saving procedure, the remaining scars can cause comorbidities, including pain, decreased neck motion, difficulty swallowing, and unsightly depressed scars. Understanding the tracheostomy technique can aid in understanding the main problems of the scars they cause. Sometimes, subcutaneous fat is removed overlying the area of the tracheostomy area, which can result in a depression in the scar [5]. After decannulation, a tracheostomy stoma is a clean-contaminated wound and is left to heal by secondary intent. The healing process around the stoma starts with the formation of granulation tissue. This tissue eventually turns into scar tissue that is attached to both the skin and subcutaneous tissue. During maturation, scar tissue contracts and adheres to the deep structures. In that case, the skin moves with movement of the trachea, which is defined as “tracheal tug.”

Many methods have been proposed for the correction of tracheal tug and scar depression [2-5,8-11]. Scars after tracheostomy

are sometimes very challenging to correct because of the severe distortion caused by the healing process. When reconstructing the tracheostomy scar, there are four main principles re-approximating each tissue layer of the neck, filling any tissue deficits, removing any hypertrophic scarring or keloids, and closing the wound horizontally [5].

The present four-layer technique repair of the tracheostomy scar is a simple and novel method that incorporates many advantages of past methods. This method uses two-layer muscle flap and de-epithelialized scar tissue to correct depressed scar with autogenic tissue to avoid the disadvantages of allogenic materials, restores the continuity of skin and muscle layers, removes remaining scar tissue and matches the direction of natural neck folds. In the surgical method introduced in this article, the first layer is the scar tissue that remains after tracheostomy, which is dissected from the surrounding tissue to correct the tracheal skin tug and de-epithelialized to correct insufficient volume. This technique can also be useful in the presence of a fistula, as closure comes without the need for additional maneuvers. The second layer, the strap muscle, and the third layer, the platysma muscle, are located between the trachea and the skin. Through this, the muscle layers serve as a buffer by sharing the tension that would be applied to the skin tissue that occurs when suturing with only the skin tissue. It supplements the volume that may be insufficient with the first layer alone and acts as an additional structure to block the fistula. The fourth layer is skin, which will be exposed after surgery, so the scar can be minimized with an incision that considers the relaxed skin tension line of the neck wrinkles and appropriate handling.

We named this technique the four-layer method because it

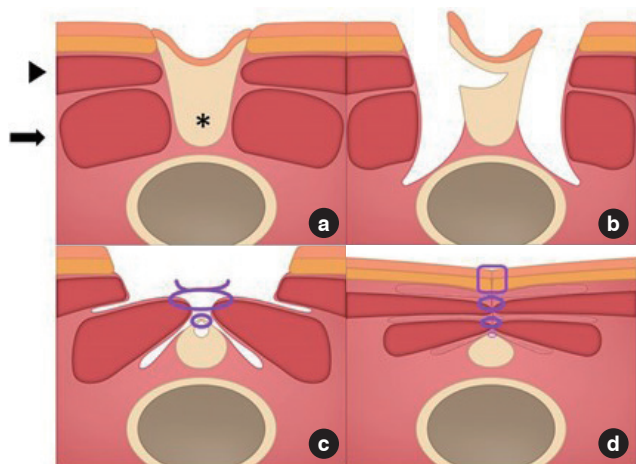


Fig. 2. Schematic figure of the procedure. (a) Depressed scar with tracheal tug. (b) Circumcised de-epithelialized cicatricial island. (c) Approximation of the strap muscles in the midline. (d) The platysma muscle suture over the strap muscles. *, scar tissue; →, strap muscles; ►, platysma muscle.



Fig. 3. Final appearance 6 months after surgery.

used four layers that complemented each other. The four-layer method is thought to benchmark several proven surgical methods among the previously published ones and can achieve a synergistic effect rather than simply combining them. In addition, this method provides a wide range of indications without selecting one method through an algorithm according to various variables to be considered during treatment, such as the severity of tracheostomy scar, functional problems such as dysphagia, cosmetic problems, and accompanying problems such as fistula. This method can be a suitable treatment method in various situations. We believe this method, which provides satisfying results, can be used in depressed scars due to tracheostomy.

NOTES

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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Ethical approval

The study was approved by the Institutional Review Board of Jeju National University College of Medicine (IRB No. 2021-08-024).

Patient consent

The patient provided written informed consent for the publication and use of his images.

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