

Technique for Tracheostoma Closure

A.L. Charyshkin, N.V. Vanina, L.M. Lebedeva, Yu.V. Charyshkina

Hospital Surgery Department, Ulyanovsk State University, ul. L. Tolstogo 42, Ulyanovsk, 432970
Russia
tel. +79510966093

Abstract: An investigation into improving tracheostoma closure using the alloplastic method is conducted. The developed technique for tracheostoma closure is described in this study (RF Patent No. 2 472 455). The results of surgical treatment of patients with tracheal stenosis during the period of 2001–2011 are presented. The proposed technique for tracheostoma closure is evaluated. The proposed method for tracheostoma closure in patients with tracheal stenosis prevents narrowing of the tracheal lumen and ensures tight tracheostoma closure.

[Charyshkin AL, Vanina NV, Lebedeva LM, Charyshkina YuV. **Technique for Tracheostoma Closure.** *Life Sci J* 2013;10(7s): 344-347] (ISSN:1097-8135). <http://www.lifesciencesite.com>.

Keywords: Tracheostoma, tracheal stenosis, alloplastic method, posttracheostomic defect, allograft, cutaneous flap.

1. Introduction

Tracheal stenosis develops in 0.1–10% of patients after the prolonged artificial pulmonary ventilation (APV) through a tracheal tube or tracheostoma [1, 3, 4].

An increase in the number of patients undergoing artificial pulmonary ventilation is caused by an increased frequency of severe polytrauma and the quality of specialized surgical treatment [5, 8]. The isolated tracheal injury is rare; the surgical treatment usually helps to avoid subsequent stenosis formation [2, 3]. The number of radical surgical intervention in patients with non-tumor stenosis of the trachea has recently decreased [1, 2, 6]. The reason for that is prompt diagnosis, development of the endoscopic methods for elimination of stenoses, the technical facilities, and the improved quality of stents (fixation and straightening ability due to their own properties) [3, 4, 7]. Another reason is the use of high-grade low-pressure tracheal tubes that enable preventing stenosis formation [5, 8, 9].

Circular resection of the trachea with end-to-end anastomosis remains the main method for surgical management of cicatricial tracheal stenosis [2, 3, 7, 10]. This is particularly true for patients with grade 4 stenosis who underwent tracheostomy: it allows one to recover the tracheal lumen and simultaneously remove the transformed tracheal tissues [4, 5, 10].

In patients with grade 1–3 stenosis who underwent tracheostomy, the posttracheostomy defect after the bougienage and the removal of cicatricial tissues is covered with a cutaneous flap [1, 2, 3].

Tracheostoma closure using cutaneous flaps only does not ensure complete closure of tracheostoma, resulting in inflammation and formation of tracheostomal fistulas [4].

Our study was aimed at improving tracheostoma closure using the alloplastic method.

2. Material and Methods

A total of 55 patients with stenosis of the upper air passages were followed up at the Ulyanovsk Regional Clinical Hospital and the Ulyanovsk Central City Clinical Hospital during the period from 2001 to 2011 (21 females and 24 males). The median age of the patients was 32.7 ± 4.2 years. At the moment of hospital admission, 20 patients had grade 1 stenosis; 35 patients had grade 2 and 3 stenosis. The causes of stenoses were as follows: tracheostomy for APV in patients with severe polytraumas – 25 cases, tracheostomy in patients with acute abdominal surgical pathology – 27 cases, tracheostomy in patients undergoing heart surgery – 1 case, and tracheostomy in patients with severe bronchial asthma – 2 cases.

All the patients underwent general examination, fibrobronchoscopy, chest x-ray, sectional roentgenography, and computer-aided tomography of the trachea.

The external respiration function before surgery was examined using peak flowmetry and functional testing.

All the patients were randomized into two groups depending on the method of tracheostoma closure. No significant differences in sex, age, and type of accompanying pathology were detected between the groups. Group 1 consisted of 30 patients, in whom the tracheostoma was closed with a cutaneous flap in the conventional manner.

Group 2 consisted of 25 patients with tracheostoma, in whom the proposed procedure for tracheostoma closure was used (Method for Surgical

Management of Tracheostoma in Patients with Tracheal Stenosis. RF Patent No. 2 473 455 (Application No. 2 011 153 674), priority on December 27, 2011; registered on January 20, 2013; Bulletin No. 2, Authors: A.L. Charyshkin, N.V. Vanina, L.M. Lebedeva, Yu.V. Charyshkina). The procedure is carried out as follows. After the surgical site is treated three times with an antiseptic agent, a 3.0 cm long vertical skin incision **1** is made (Fig. 1) on the anterior surface of the neck **2** under local anesthesia (at a distance of 2.0–3.0 cm from the tracheostoma **3**). A 3.0 x 3.0 cm graft bed **4** is bluntly formed in the subcutaneous fat layer. A 2.5 x 2.5 cm graft made of synthetic material **5** is placed into the bed **4** for 25–30 days prior to the second stage of surgical treatment; skin sutures are used.

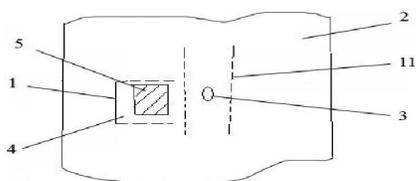


Fig. 1. Preliminary placement of an allograft onto the anterior surface of the neck for 25–30 days before the second stage of the surgical treatment was started. **1** – vertical skin incision; **2** – anterior surface of the neck; **3** – tracheostoma; **4** – bed in the subcutaneous fat layer; **5** – allograft; **11** – trachea.

At the second stage of surgical treatment conducted 25–30 days after the first stage, the post-operative scar on the anterior surface **2** of the neck is excised. The skin confined to the allograft **5** intergrown with connective tissue is separated towards tracheostoma **3**; the pedicle flap with allograft **5** intergrown with the connective tissue is left at the margin of the tracheostoma **3**.

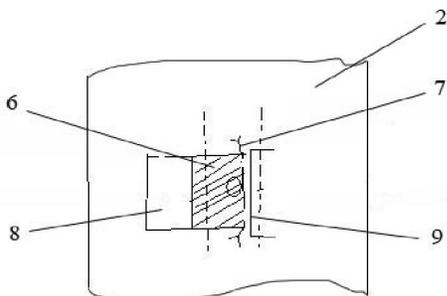


Fig. 2. The second stage of surgical treatment of tracheostoma closure. **6** – first cutaneous flap with the allograft **5** intergrown with the connective tissue;

8 – wound surface; **9** – vertical skin incision on the anterior surface **2** of the neck on the opposite side along the tracheostoma margin **3**.

The first cutaneous flap **6** (Fig. 2) with pedicle allograft **5** intergrown with the connective tissue is formed; it is placed onto tracheostoma **3** (with epidermis facing down) and is sewn to the opposite margin of the tracheostoma **3** using nodular sutures **7**. The wound surface **8** is formed.

A 3.0 cm long vertical skin incision **9** is subsequently made on the anterior surface **2** of the neck on the opposite side of tracheostoma **3** margin; the second cutaneous flap **10** is mobilized (Fig. 3) and placed onto the sewn first cutaneous flap **6** with the allograft **5** intergrown with the connective tissue and the wound surface **8**. The second cutaneous flap **10** is immobilized using sutures **12** on skin at the side of the first cutaneous flap **6** with allograft **5** intergrown with the connective tissue, which had previously been cut. The sutures **7** and **12** are located outwards of tracheostoma **3**, on the opposite sides, and at different depths.

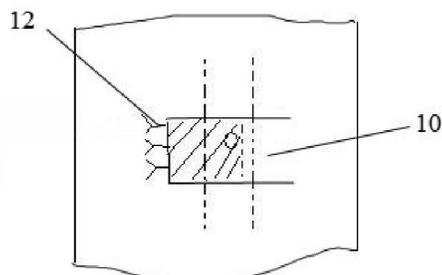


Fig. 3. The final surgery scheme. **10** – the second cutaneous flap is fixed and placed onto the first cutaneous flap **6** with the allograft **5** intergrown with the connective tissue and the wound surface **8**; **12** – sutures immobilizing the second cutaneous flap **10** on skin on the side of the first cutaneous flap with allograft **5** intergrown with the connective tissue.

All the patients received antibiotic treatment to prevent complications in the post-operative period. The state of the trachea during the post-operative period was controlled by conducting fibrotracheoscopy.

The resolution of the Ethics Committee of the Institute of Medicine, Ecology, and Physical Culture of the Ulyanovsk State University regarding the clinical trials for using the proposed method for tracheostoma closure, purported efficiency and safety were scientifically justified. The trials were carried out in compliance with the ethical standards established in the Declaration of Helsinki in 1964.

Voluntary informed consent for medical intervention was obtained from all the patients.

3. Results

In the preoperative period, after the endoscopic bougienage during fibrotracheoscopy and rigid bronchoscopy, the cicatricial tissue and granulations narrowing the tracheal lumen were removed under ultrasound guidance using forceps. Sanitation bronchoscopy was carried out in patients with erosive and ulcerative tracheitis: drugs with different mechanisms of action were introduced directly into the area of inflammation.

Indications for using endoscopic surgery as an independent method to treat the postintubation changes in the upper air passages were the presence of granulations, intraluminal septa (parietal, falciform, semilunar, circular “membranes”), and a cicatricial-granulation “overhang” above the tracheostoma.

The procedure for the removal of cicatricial-granulation formations in the larynx and trachea depended on the number and size of granulations. If they were less than 3 mm in size, electrocoagulation was carried out using a diathermal loop or a coagulator. If the size of formations was greater than 3 mm, a diathermal loop was applied at to base, and the formations were excised by feeding short discharges of high-frequency current and removed.

The ulcers formed at the site of the removed granulations epithelialized on day 3–5; hence, the control endoscopic examination was conducted not earlier than this time.

The cicatricial-granulation “overhang” above the tracheostoma was the indication for removal if it was larger than 0.5 cm in diameter.

When studying the results of surgical intervention, lethal outcomes were observed in neither group.

Among 30 patients in group 1, tracheostomy fistulas were formed in five patients (16.7%) during the early post-operative period; fistulas were closed in two patients using conservative measures. Tracheostomy fistulas with stenosis of the tracheal lumen developed in 3 (10%) patients in group 1. A tracheal tube was repeatedly inserted into the distal compartment of the trachea. In group 1, the treatment provided good clinical results in 27 patients (90%); three (10%) patients remained chronic cannula users with severe accompanying pathology. Healing of the post-operative wounds in group 1 patients was observed on day 8.6 ± 1.3 .

Good clinical results were obtained in group 2. No complications were observed. Healing of the post-operative wounds in patients was observed on

day 7.4 ± 0.9 . No pathological changes in the trachea were observed after 6 and 12 months.

4. Discussions

The endoscopic methods and tracheoplasty are used in modern surgery of cicatricial stenosis of the trachea [1, 4]. After the tracheal lumen is recovered, it needs to be preserved for a long time (i.e., restenosis needs to be prevented) [2]. The repeated narrowing can be prevented using various cage-like structures that maintain the tracheal lumen [3]. We believe that the proposed method combined with the endoscopic methods allows one to reduce the number of recurrent tracheal stenoses.

Thus, the proposed method for tracheostoma closure in patients with tracheal stenosis eliminates narrowing of the tracheal lumen, ensures tight tracheostoma closure due to the cage-like structure, and reduces the development of early post-operative complications.

Corresponding Author:

Dr. A.L. Charyshkin
Hospital Surgery Department
Ulyanovsk State University, ul. L. Tolstogo 42,
Ulyanovsk, 432970 Russia
tel. +79510966093

References

1. Kirasirova, E.A., F.S. Karimova, V.A. Kabanov, R.B. Khamzalieva and N.V. Lafutkina, 2006. Treatment Algorithm for Stenosis of Larynx and the Cervical Trachea of Different Etiologies. *Otorhinolaryngology Bulletin No. 2*: 20–24.
2. Parchin, V.D., 2003. Surgery for Cicatricial Tracheal Stenoses. Moscow.
3. Perel'man, M.I., 1999. Cicatricial Tracheal Stenosis: Prevention and Treatment. In the Proceedings of the All-Russian Scientific and Practical Conference “Prevention, Diagnosis, and Treatment of Cicatricial Tracheal Stenoses”, pp: 3–4.
4. Sanginov, A.B., 2011. Surgical treatment of cicatricial stenoses of trachea and the distal laryngeal compartment. Dr. Med. Sci. Thesis. St. Petersburg, p. 34.
5. Flanagan, K., R. Miller, et al., 2000. Guidelines for the Care of Patients with Tracheostomy Tubes. London: St. George's Healthcare NHS Trust, p. 40.
6. Grilo, H., 2004. Surgery of the Trachea and Bronchi. London: BC Decker Inc. Hamilton.
7. Keller, C.A., R. Hinerman, A. Singh, et al., 2001. The Use of Endoscopic Argon Plasma Coagulation in Airway Complication after Solid

- Organ Transplantation. *Chest*, 119 (6): 1968—1975.
8. Kollig, E., U. Heydenreich, B. Roetman, et al., 2000. Ultrasound and Bronchoscopic Controlled Percutaneous Tracheostomy on Trauma ICU. *Injury*, 31: 663–668.
 9. Pryor, J.P., P.M. Reilly and M.B. Shapiro, 2000. Surgical Airway Management in the Intensive Care Unit. *Critical Care Clinics*, 16: 473–488.
 10. Succo, G., E. Crosetti, G.C. Pecorari, et al, 2002. Complications of Tracheostomy in Critically Ill Patients: Comparison of Dilatation and Surgical Techniques. *Acta Otorhinolaryngologica Italica*, 22 (4), Suppl. 71: 1–11.

10/05/2013