

Conference paper

## Surgical Treatment of Atresia in the Nasal Cavity with Using a Superelastic TiNi Foil

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### Abstract

The use of superelastic NiTi (nickelid titanium ) foils for patients with atresia of the nasal cavity as a structural device provide a firm fit of the flap and its engraftment in the donor area. Due to its superelasticity and reverse formability the construction reliably ensures the formation of the nasal passage and restoration of nasal breathing. Immediate and long-term functional and aesthetic results of surgery and absence of recurrence in these patients demonstrates the effectiveness of the proposed method with the recommendations of its use as a method of choice.

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### 1 Introduction

Eliminating a deep atresia of the nasal passage is considered one of the most difficult sections for maxillofacial, plastic surgeons and otorhinolaryngologist. When performing this surgery it is necessary not only to restore the anatomical contours of the external nose, but also to achieve the main goal – free nasal breathing. It is known that atresia of the nasal passages of patients is the result of various infectious diseases such as smallpox, diphtheria of the nose, scarlet fever, syphilis, lupus, noma and others, which patients have had in the childhood. In addition, these diseases may occur as a result of traumatic injuries, especially with gunshot and cancer diseases [1, 3]. Atresia of the nasal cavity can be complete and incomplete, external and deep as well as bony. Eliminating of the external forms of the nasal atresia is not much difficult; however, a surgical reconstruction of complete and deep atresia in the nasal cavities is of significant difficulty. It should be noted that to date a variety of methods are proposed and developed to eliminate the atresia of the nasal passages in the nasal cavity which have been described in detail in the monograph of A.S. Proskuryakov “Restorative surgery of the ear, nose and throat” in 1947.

The latest developments in this area include a method developed by Mukhin M.V. which was described in details in a special edition in 1998.

All of the methods used for these purposes include the use of pedicle flaps of the surrounding perirhinal tissues of the face, or free skin grafts, with the mandatory use of inserts, distractors and various fixing devices constructed for a firm fit of the transplanted grafts to the wound surface that ensure restoration patency of the nasal passages. However, most of the proposed constructions do not provide adequate firm fit of grafts, moreover some of them cover the lumen of nasal passage, causing difficulty in breathing [1, 3, 4]. This and other factors result in the final adversely affects engraftment of flaps.

In order to eliminate deep atresia in the nasal cavity and for the full restoration of nasal patency in patients, prevention of its recurrence and to form lumen we use the superelastic TiNi (nickelid titanium) foils that provide positive dynamics of engraftment of transplanted grafts in the postoperative period.

The objective of the research is to increase the results of surgical procedures to eliminate deep atresia in the nasal cavity and the prevention of its recurrence.

## 2 Material and Methods

For optimum fit and stable hold of the transplanted skin flaps in eliminating deep full atresia of nasal cavity we used superelastic TiNi (nickelid titanium) foil with different thickness and width for 5 patients, which is manufactured and produced in the Research Institute of Medical Materials of the Tomsk State University.

For our purposes we used foil with thickness of 1 mm, a width of 2 cm, which was twisted and had a small size in diameter, which allowed freely entering and placing it on top of flattened flap in the nasal passage. Properties of superelastic and a reverse forming of the foil allowed to hold tightly and to securely fix the transplanted graft. Because of these properties the construction contributes to the optimal regeneration of the flap to its full completion and allows to form the nasal passage, and to restore nasal breathing. Moreover, thanks to the bactericidal property of a material by using the construction there is no need for application of antiseptic agents.

To illustrate this case we bring an example from the clinical practice.

Patient A.M. born in 1985, medical history № 1289554, was admitted to the adult Maxillofacial Surgery department of National Medical Center with complaints of difficult breathing and disfiguring scars in the left nasal passage which completely cover the lumen.

It was described in the anamnesis that a complete atresia of the nasal passage was caused due to noma disease in early childhood, which subsequently led to the nose



Fig. 1. – Patient A.M. Diagnosis: Deep atresia of the nasal cavity

wing defect. In the process of scarring the strained left wing of the nose stuck to the nasal septum, and caused atresia of the left nasal passage (Fig. 1).

During the external examination of the patient it has been noted that the left wing of the nose is bifurcated by scars and the inner surface is soldered to the septum, and pear-shaped hole is completely absent. The anterior rhinoscopy is impossible. There is a secondary anomaly of the upper jaw due to its deformation. Type of breathing is by mouth. The teeth are arranged randomly. The movement of the lower jaw is free, no function is impaired. In addition, during an overall examination it has been revealed that the patient has epileptic seizures, which were associated with the ongoing chronic hypoxia of the brain, due to violation of external breathing.

Under general anesthesia the patient has been operated: the elimination of complete atresia of deep nasal passage. During the operation, after the removal of scars and restoration of the wing position of the nose there has been formed an extensive wound surface, which was covered by skin-fat pedicle flap withdrawn from the nasolabial fold. To restore the missing wing cartilage an adequate size of the cartilage withdrawn from the rook of ear has been used. (Fig. 2).

The skin flap in the nasolabial folds has been detached and moved toward the wound surface caused after the removal of scars and has been turned to form the nasal passage with placing a rook cartilage between their petals. After the restoration of the nasal passage, the formed block of tissue has been temporarily fixed with plastic structure (Fig. 3).

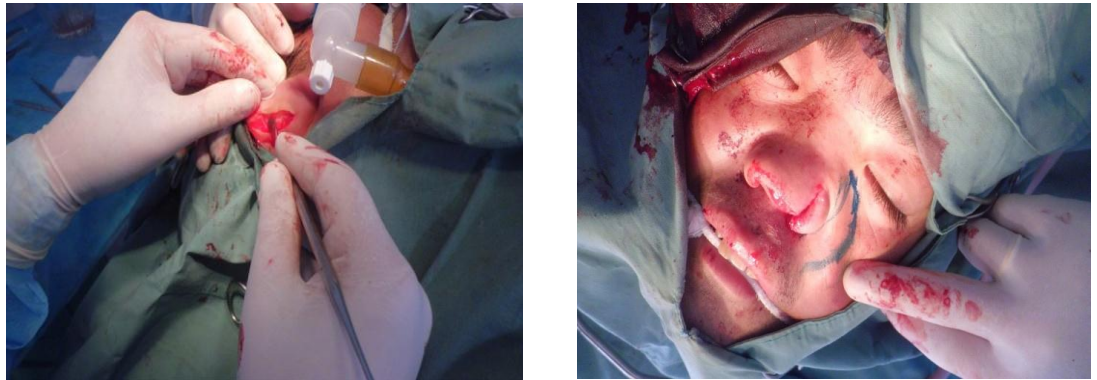


Fig. 2. – Withdrawal of an adequate size of the cartilage from the rook of ear and skin pedicle flap in the area of the nasolabial fold to form a nasal passage

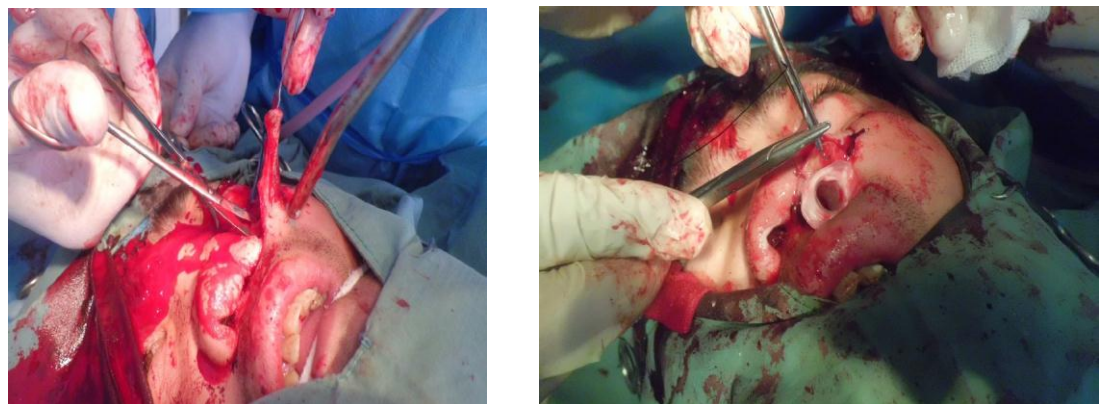


Fig. 3. – Separating a skin graft in the area of nasolabial fold. The nasal passage is formed; the flap is fixed by a plastic construction

The next day after the surgery during the ligation a fixing plastic construction was replaced by superelastic foil cut ex tempore from TiNi (nickelid titanium ) (Fig. 4).

The postoperative period was satisfactory, wound healing was primary, and the skin flaps displaced had fully taken root. As a result of the operation it became possible to



Fig. 4. – Superelastic foil made of NiTi



eliminate the deep full nasal atresia, and fully restore the nasal passage, consequently, the nasal breathing. Examination of the patient in one year period demonstrated stable positive results both at the functional and aesthetical levels (Fig. 5).



Fig. 5. – Patient A.M. Diagnosis: Deep nasal atresia. Patient's condition after the surgery and one year after the restoration of the nasal passage.

The results of surgical interventions by the above-described method for all patients with atresia of the nasal cavity have shown a full recovery not only of the nasal passage and breathing, but also the shape of the nose.

### 3 Conclusions

The use of superelastic TiNi (nickelid titanium) foils for patients with atresia of the nasal cavity as a structural device provide a firm fit of the flap and its engraftment in the donor area. Due to its superelasticity and reverse formability the construction reliably ensures the formation of the nasal passage and restoration of nasal breathing. Immediate and long-term functional and aesthetic results of surgery and absence of recurrence in these patients demonstrates the effectiveness of the proposed method with the recommendations of its use as a method of choice.

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