Surgical closure of oronasal communications

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ABSTRACT:

Background: An oronasal communication (ONC) is a pathological opening between the oral and nasal cavities, normally separated by the hard and soft palate. The integrity of the palate is essential for the physiological acts of respiration, mastication, digestion, and phonetics. The persistence of ONC or its unsuccessful closure leads to a permanent communication between the cavities, called an oronasal fistula (ONF). The most common reason for a congenital ONC/ONF is cleft defects, while for acquired ONC/ONF are trauma, tumors, and iatrogenic causes. The main symptoms of ONC/ONF include liquid regurgitation and leakage through the nose, rhinitis, speech disorders, halitosis, and persistent and recurrent respiratory and ear infections.

Aim: This review aims to summarize and compare the treatment methods for surgical closure of ONC/ONF, define and point out their advantages and limitations, and give recommendations for further research.

Material and methods: An electronic search was performed via four electronic databases: Pubmed, Scopus, Web of Science, and Google Scholar and using the following keywords: (((oronasal) OR (oro-nasal)) AND ((communication) OR (fistula)) AND ((cleft) AND (palate))). After analysis of the obtained data, 28 articles were included in this review.

Results and discussion: Different soft-tissue flaps and their modifications have been proposed to provide secure closure with minimum post-operative complications and bone deformities. Local flaps, if available, are preferred over distant soft tissue flaps. Some novel techniques utilize various grafts and tissue regeneration materials, such as acellular dermal matrix, bone morphogenic proteins, collagen, human amniotic membrane, etc.

Conclusion: Various methods for ONC/ONF closure have been suggested over the years. The surgical management aims to provide a soft-tissue barrier between the oral and nasal cavities and, thus, restore their anatomical integrity and functions. The factors that should be considered before the surgery are etiology, location, size of the communication, quality and quantity of the surrounding soft tissues in the area, age of the patient, and comorbidities.

Background

An oronasal communication (ONC) is a pathological opening between the oral and nasal cavities, normally separated by the hard and soft palate. An intrauterine fusion of the palatal processes of the maxilla and the horizontal plates of the palatal bone forms the hard palate. Its integrity is essential for the physiological acts of respiration, mastication, digestion, and phonetics. The persistence of ONC or its unsuccessful closure leads to a permanent communication between the cavities called an oronasal fistula (ONF). It is a pathological tract covered by epithelium (1). The etiological factors for ONC/ONF can be broadly classified as congenital and acquired. Regarding their size, they are divided into small (≤ 2 mm), medium (3-5 mm), and large (> 5mm) (2). ONF can be located on the hard palate, the soft palate, or the junction between them. They can also involve the alveolar ridge and the upper lip (3). According to the Pittsburg Fistula Classification, there are 7 types of ONF. It can be positioned on the uvula (type 1), soft palate (type 2), between the hard and soft palate (type 3), hard palate (type 4), incisive foramen (type 5), palatal side of the alveolar ridge (type 6) and vestibular side of the ridge (type 7) (4).

The reported incidence of ONC is 5 – 35% (5) and it shows a high recurrence rate – up to 37% (6). The main reasons for that are closure under tension, flap necrosis, and postsurgical infections (1).

The most common reason for a congenital ONC/ONF is cleft defects, while the most common causes for acquired ONC/ONF are trauma, tumors,

infections (periapical pathology, osteomyelitis, sinusitis, specific infection, such as actinomycosis, syphilis, tuberculosis, etc.), iatrogenic causes (post-operative, radiotherapy in the maxillofacial region, chemotherapy) (1, 7,8).

The main symptoms of ONC/ONF include liquid regurgitation and leakage through the nose, rhinitis, speech disorders, halitosis, and persistent and recurrent respiratory and ear infections.

Aim

This review aims to summarize and compare the treatment methods for surgical closure of ONC/ONF, define and point out their advantages, indications, and limitations, and give recommendations for further research.

Material and methods

an electronic search was performed via four electronic databases: Pubmed, Scopus, Web of Science, and Google Scholar and using the following keywords: (((oronasal) OR (oro-nasal)) AND ((communication) OR (fistula)) AND ((cleft) AND (palate))). After analysis of the obtained data, 28 articles were included in this review.

Results and discussion

the treatment of ONC/ONF depends on local and general factors. The local include the size of ONC/ONF, their location, the amount of remaining tissues, and previous surgical attempts. General factors are patient age, immune status, and comorbidities (1).

Prosthetic closure (dentures, obturators) is indicated in cases of large defects after jaw resections due to neoplasm, elderly patients with compromised medical status, and after multiple unsuccessful attempts for surgical closure. However, the definite closure is always surgical (1).

The management of congenital ONC (cleft palate) focuses on three significant aspects: anatomical closure, minimization of growth disturbances, and development of normal speech (9,10). The reconstruction of the velopharyngeal valve is essential for the masticatory function (11). There is a study heterogeneity regarding the proper timing for surgical treatment. While early reconstruction provides proper articulation, speech development, and social integration, it can cause disturbances in jaw growth (9,12). Conversely, delayed reconstruction may lead to speech disturbances.

The surgical closure of ONC should be two-layered to increase the stability of the restoration and reduce the risk of failure. Single-layered closure usually leads to recurrence. The first step is restoration of the floor of the nasal cavity. It can be achieved by turnover flaps from the medial and lateral margin of the cleft. Then a palatal rotational flap can be used to create the second layer (13). Sometimes a bone or cartilage graft can be added between these layers to obtain e stable 3-layered closure (1).

Closure of ONF in children less than 5 years is controversial because the jaw is not fully developed at this age, the deperiostation of the palate further compromises the blood supply, and scarring after surgery interferes with teeth eruption (13).

Different soft-tissue flaps and their modifications have been proposed over the years to provide secure closure with minimum post-operative complications and bone deformities. Local flaps, if available, are preferred over distant soft tissue flaps.

Buccal soft-tissue flaps are pedicle flaps supplied by the submucosal blood vessels (1). Their major disadvantage is the reduction of the vestibular depth and the amount of attached gingiva. They are limited to small ONC/ONF on the alveolar ridge.

Palatal rotational flaps can be used for defects on the palate. They are supplied by the greater palatine artery. Their major drawback is the lack of elasticity and difficult rotation. The size of the flap must exceed the size of the defect to provide adequate coverage (13, 14).

Tongue flaps are indicated in cases of large persistent or recurrent ONF and scarce amount of palatal soft tissues. Their major advantages are a high amount of tissues, excellent blood supply, great rotational ability, and less post-operative morbidity (1,15). Second surgery for interruption of the pedicle is one of the drawbacks of this method. Another major drawback is the need for tube feeding during the healing.

Palatoplasty (Langenbeck) is performed by two

flaps lateral to the defect which are mobilized and placed over the ONC. The technique is performed in layers – first closing the opening in the nasal cavity (suture nots toward the nasal cavity to avoid dead spaces) and then in the oral cavity (1). The one-stage technique, the so-called "hole-in-one" restoration, is one of the most popular methods nowadays, especially in cases with limited tissues (16). It can be performed for both hard and soft palate surgery in infants with cleft palates and has been demonstrated to have the advantage of minimal bone growth disturbances (11). The two-staged method prioritizes facial growth but has the drawback of delayed and disturbed speech (17-19).

A modified Langenbeck flap can be used in cases of long (>15 mm) and narrow fistulas (≤7 mm). Tension-free closure in two layers is required. Large and round ONFs can be closed using a two-layered technique with turnover flaps to create the nasal lining. If the ONF is small and round – the technique is similar but with only one turnover flap (13).

Myomucosal flaps with blood supply from the facial artery (Pribaz, 1992) can be used to close large ONCs that spread from the anterior palate to the mid-palatal area. The flap was first suggested for the reconstruction of the lip and vermillion. It contains parts of the buccal mucosa, submucosa, and buccinator muscle (20,21).

Free soft tissue grafts are an alternative to the local plastic coverage. They can be composed of skin, fascia, and adipose tissue in different combinations and ratios (1).

Some novel techniques utilize different grafts and tissue regeneration materials, such as acellular dermal matrix (22-24), bone morphogenic proteins, collagen, human amniotic membrane (25,26), etc. Distraction osteogenesis has been also suggested as an effective method (27).

Methods and timing for the reconstruction are pivotal for surgery success. However, there is still no consensus on either and direct comparison between surgical techniques is difficult (12,28).

There is a study heterogeneity regarding the indications and limitations of the currently used protocols. Further research, including randomized controlled clinical trials, systematic reviews, and meta-analyses, is required to compare these methods and give some recommendations for their use. Furthermore, some modifications of these techniques or the adoption of novel ones can improve surgical success and long-term results.

Conclusion

Various methods for ONC/ONF closure have been suggested over the years. The surgical management aims to provide a soft-tissue barrier between the oral and nasal cavities and, thus, restore their anatomical integrity and functions. The factors that should be considered before the surgery are etiology, location, size of the communication, quality and quantity of the surrounding soft tissues in the area, age of the patient, and comorbidities.

Further research is necessary to compare the currently used methods and give some recommendations for their use, modification, and improvement.

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