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Comprehensive Reconstruction of Facial Defects: A Case Study Utilizing Combined Skin Flap Techniques and Composite Graft Chondrocutaneus

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ABSTRACT

Post-operative defects of skin tumor removal in the facial area, especially the nasal area, are very common. Reconstruction of defects in the nasal, presents a great challenge for surgeons where the presence of asymmetric conditions, changes in skin color and texture will be easily visible and cause changes in facial shape. In addition, to maintain and restore the function of the defective part that will be reconstructed, it requires high precision and expertise to obtain good results aesthetically and functionally. In this article, we present 3 cases of the combined use of auricular chondrocutaneous composite graft and paramedian forehead flap in defect reconstruction full tickness nasal ala after tumor excision. Two cases were unilateral reconstruction and 1 other case was bilateral reconstruction. Previously, the patient had been educated about the choice of surgical technique, risks and benefits of the surgical technique to be used and the patient had agreed to it. The reconstruction results in all three cases showed excellent results both aesthetically and functionally. The shape and contour of the thin auricular cartilage are very suitable for forming the nasal ala without the need for surgical molding as in other cartilage graft donors. The thin skin attached to the cartilage not only forms liningwhich is perfect but also forms a wide nostril space. The weakness of the auricular chondrocutaneous composite graft in terms of vascularization supply can be overcome with paramedian forehead flap, which is also a large skin donor with contours and skin color that are most similar to the skin of the nasal. This procedure provides excellent results in terms of aesthetics and functionality, as well as minimal complications and donor mobility, so it can be the procedure of choice for reconstruction of large defects in the nasal after tumor removal.

Keywords: Maxillofacial skin flap, reconstructive surgery

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INTRODUCTION

Facial deformities resulting from post-operative excision of skin tumors, particularly in the nasal region, remain a significant challenge in reconstructive surgery. Non-melanoma skin cancers (NMSCs) predominantly affect the head and neck areas, with the nose being the most frequently involved site due to its central facial location and constant exposure to ultraviolet radiation (Al-Bdour & Al-Khateeb, 2019; Vaidya et al., 2019; Uzun et al., 2015; Efthymiou &

Georgolios, 2022). These defects not only compromise respiratory and aesthetic functions but also lead to substantial psychosocial consequences, including social withdrawal, diminished self-esteem, and depression (Vaidya et al., 2019; Sclafani & Thomas, 2012; Teltzrow et al., 2004; Zide & Glat, 2001). Therefore, effective and aesthetic nasal reconstruction is not merely cosmetic it is central to restoring overall health and quality of life for affected patients.

Nasal defects, especially those involving the nasal ala, present significant reconstructive challenges due to the region's complex anatomy and critical respiratory functions (Efthymiou & Georgolios, 2022; Bednarek et al., 2019; Uzun et al., 2015; Rosenberg & Gupta, 2015). Full-thickness defects that compromise the skin, cartilage, and internal lining can lead to serious complications, such as alar stenosis, nasal valve collapse, and airway obstruction if not meticulously reconstructed (Sclafani & Thomas, 2012; Al-Bdour & Al-Khateeb, 2019; Vaidya et al., 2019; Teltzrow et al., 2004). Achieving symmetry, proper contour, and a structurally sound support framework is essential for both functionality and aesthetics, especially since nasal deformities are prominently visible and socially impactful.

Recent studies have explored various strategies for achieving optimal nasal reconstruction outcomes. Vaidya et al. (2019) assessed patient-reported satisfaction using the FACE-Q Skin Cancer Module and emphasized the growing importance of aesthetic outcomes in surgical success. Similarly, Rosenberg and Gupta (2015) highlighted the paramedian forehead flap as a reliable reconstructive method for nasal lining due to its rich vascularity and flexibility. Bednarek et al. (2019) reported the effective use of cross-paramedian forehead flaps over nearly two decades, validating its versatility for large and complex nasal defects. Moreover, Efthymiou and Georgolios (2022) emphasized technical strategies for improving the survival of auricular composite grafts, especially in alar and sidewall reconstruction, underscoring the practical relevance of combining methods.

This study introduces a combined approach utilizing auricular chondrocutaneous composite grafts and paramedian forehead flaps for reconstructing full-thickness nasal defects following tumor excision. The proposed technique allows for the simultaneous or staged restoration of skin, cartilage, and mucosal lining, offering a holistic and efficient surgical solution (Efthymiou & Georgolios, 2022; Bednarek et al., 2019; Al-Bdour & Al-Khateeb, 2019; Uzun et al., 2015). Compared to traditional methods such as costal cartilage grafts or local rotational flaps, this technique presents superior long-term stability, reduced resorption, and improved skin color and texture match. These advantages make it especially suitable for defects larger than 1 cm that would otherwise require multi-modal or multiple-staged repair approaches.

The objective of this study is to provide a comprehensive clinical description and outcome evaluation of using auricular chondrocutaneous composite grafts in combination with paramedian forehead flaps for nasal reconstruction after wide excision of basal cell carcinoma. The focus is placed on both functional respiratory outcomes and aesthetic facial restoration.

This study is expected to offer valuable insights for clinical practice by demonstrating a reproducible and effective reconstructive strategy for extensive nasal defects. The findings contribute to the growing field of facial reconstructive surgery and may serve as a decision-making guide for surgeons managing post-oncologic facial deformities, particularly those requiring multi-

layer restoration of the nasal ala.

METHOD

This study employed a descriptive qualitative approach in the form of a clinical case series, aiming to elaborate on the procedures, outcomes, and clinical implications of combining auricular chondrocutaneous composite grafts and paramedian forehead flaps for nasal reconstruction following tumor excision. The subjects consisted of three male patients, aged between 57 and 72 years, who underwent extensive nasal reconstruction after surgical excision of basal cell carcinoma. The study was conducted at the Department of Head and Neck Surgery in a referral hospital. Data collection was carried out retrospectively through medical records, pre- and postoperative clinical photographs, and postoperative evaluations conducted by the reconstructive surgical team.

The research instruments included medical documentation detailing patient demographics, histopathological findings, surgical procedures, graft and flap techniques, and clinical follow-up at four weeks postoperatively and during secondary reconstruction stages. Photographic documentation was used to support visual analysis of reconstructive success in terms of aesthetic outcomes and functional restoration. Data were gathered through systematic observation and documentation of the surgical outcomes, with particular attention to nostril symmetry, structural integrity of the nasal ala during inspiration, healing of the donor sites, and postoperative facial aesthetics.

Data were analyzed descriptively using a narrative chronological format for each case, comparing the surgical plans, intraoperative execution, and clinical outcomes. Additionally, literature review was conducted to support interpretation of the clinical findings, especially regarding the effectiveness of auricular composite grafts and paramedian forehead flaps in managing complex nasal defects. Data validity was reinforced through source triangulation, including medical records, visual observations, and expert assessments from head and neck surgeons. Ethical approval for this study was obtained from the hospital's ethics committee. Patient identities were anonymized, and all data were used strictly for academic and clinical research purposes.

RESULTS AND DISCUSSION

Case Report

Case 1.

Figure 1. First patient. A. Preoperative basalioma image. B. Post-tumor excision defect. C. Post-first stage reconstruction. D. Post-second stage reconstruction (cut

flap). The nostrils are firm and symmetrical. The aesthetics and functionality are excellent

A 65-year-old male patient came to the Head and Neck Surgery Department with complaints of lumpy wounds on the nasal to the upper lip that had not healed for 2 years. The wound had been operated on 2 years previously, but the wound reappeared. From the examination results, a tumor measuring 4 cm x 4 cm was found on the left nasal ala, extending to 2/3 of the upper lip and columella. The tumor infiltrated the entire layer of the left nasal ala. The results of the fine needle biopsy examination showed the pathological type of basalioma.

The therapy performed on this patient was wide excision with general anesthesia, accompanied by a.frozen section examination intraoperatively to achieve free margin. The resulting defect is quite extensive covering 80% of the upper lip, 100% of the columella and 100% of the left nasal ala. To close the upper lip defect, using a combination of cheek advancement flap and cross lip flap (Abbe flap). Closure of the defect full thickness left nasal ala was performed with a combination of auricular chondrocutaneous composite graft and paramedian forehead flap. Paramedian forehead flap is used as a donor of the outer skin of the left nasal ala and columella, while the cartilage framework and lining. Left nasal ala was formed by auricular chondrocutaneous composite graft. The donor of the auricular chondrocutaneous composite graft was taken from the left ear concha. The size of the graft taken was 1.5 cm x 1 cm. The cartilage graft was sutured to the nasal tip cartilage and to the maxillary periosteum with 4.0 nylon thread. The skin graft was sutured to the left nasal mucosa lining on the inside with 4.0 polyglactin thread and skin from the paramedian forehead flap on the outside with 4.0 nylon. The donor defect was sutured primarily. At 4 weeks after surgery, the Abbe flap and paramedian forehead flap were cut.

Postoperative evaluation found that the left nasal ala that was formed was quite sturdy. The formed nostrils looked round and symmetrical. Collapse of the nasal ala did not occur even during deep inspiration. The donor graft area on the left ear healed perfectly with unchanged anatomical shape. Functionally and aesthetically, the reconstruction results were very satisfactory.

Case 2

Figure 2. Second patient A. Preoperative view of basalioma. B. After first stage reconstruction, viewed from the front. C. After first stage reconstruction,

viewed from the side. Nostril looks sturdy and symmetrical D. Auricle donor with excellent postoperative aesthetics

A 57-year-old male patient came to the Head and Neck Surgery Department with a complaint of a non-healing wound in the nasal area since 1 year ago. The wound was blackish in color on the nasal dorsum, measuring 4 cm x 3.5 cm covering the nasal tip, columella and right and left nasal ala. The results of a fine needle biopsy showed a pathological type of basalioma. The choice of therapy taken for this patient was wide excision under general anesthesia, accompanied by an frozen section examination to ensure the radicality of tumor excision. The margin achieved is at least 0.5 cm from the edge of the tumor. The defect that occurred in this patient includes the nasal dorsum, nasal tip, columella and the entire layer of the right and left nasal ala. Closure of the outer skin defect on the dorsum, tip, columella and nasal ala can be done with a paramedian forehead flap. To replace the cartilage and lining nasal, bilateral auricular chondrocutaneous composite graft was performed. The graft procedure was performed in the same procedure as in the previous case. Closure of the donor area forehead paramedian was performed with skin graft, while the donor area of the auricular composite graft was closed primarily. The final result of this patient's reconstruction was very satisfactory. The nostrils formed were quite sturdy and symmetrical. The patient had no problems breathing and the resulting nasal shape was quite good aesthetically. The donor area of the graft could heal perfectly and did not cause ear deformities.

Case 3

Figure 3. Third Patient A. Preoperative basalioma image. B. Post-tumor excision defect. C. After first stage reconstruction, viewed from the front. D. After second stage reconstruction (flap cut), viewed from the side, nostrils are firm and symmetrical

A 72-year-old male farmer presented to the Head and Neck Surgery Department with a facial lesion that had developed over a ten-year period. Initially, the lesion appeared as a pigmented macule that ulcerated after repeated trauma. On examination, the ulcerated lesion measured 8 cm x 6 cm with irregular borders that bled easily, was reddish in color and had a keratin pearly

border with the lesion extending from the nasal tip and left nasal dorsum to the left medial canthus and infraorbital region to the left maxilla. The tumor had infiltrated all layers of the left nasal cavity. Pathological examination revealed basal cell carcinoma.

The therapy taken for this patient was wide excision with general anesthesia. The free margin that must be achieved is 0.5 cm from the edge of the tumor. This action resulted in extensive tissue loss on the left side of the face covering 80% of the dorsum nassi, buccal, and 100% of the left nasal ala. Closure of the defect fullthickness in the tip, dorsum and left nasal ala was performed with a combination of auricular chondrocutaneous composite graft and paramedian forehead flap. Paramedian forehead flap is used for external skin donors on the tip, nasal ala and left dorsum while the cartilage framework and lining left nasal ala was formed by auricular chondrocutaneous composite graft. Planned 4 weeks after surgery, flap cutting was performed. Donor defect paramedian forehead flap closure is performed with skin graft, while primary closure is performed for auricular composite graft donors.

After post-operative evaluation, it was found that the reconstructed left nasal ala was quite sturdy with the nostril successfully formed giving round and symmetrical results. The nasal ala did not collapse during deep inspiration while the donor graft area on the left ear healed perfectly with an unchanged anatomical shape. The reconstruction results were very satisfying in terms of aesthetics and functionality.

The concept of nasal reconstruction is not only centered on replacing lost tissue, but also paying attention to the similarity of color and texture aesthetically and restoring function. The nasal consists of 9 subunits divided based on differences in skin thickness, supporting structure and surface convexity, namely the tip, dorsum, a pair of sidewall, a pair of ala, a pair of facets and the columella. The ala subunit is formed by thin non- sebaceous skin, cartilage and hairy skin as nasal lining.[1,3]

The nasal cartilage can be reconstructed with a chondromucosal pedicle flap from the septum or with free graft. Chondromucosal pedicle flap from the septum or septal door flap with a hinge has a good vascular supply to its cartilage and provides nasal lining, but this technique can only be performed if the septum is intact and requires a technique molding which is good for getting a concave shape according to the contour of the ala.[2]

Auricular chondrocutaneous composite graft as a method free graft for the first nasal reconstruction was performed by Koening in 1902.[4] This graft consists of skin on both sides and cartilage taken randomly with procedure *en bloc*. Auricular composite grafts are ideal for nasal reconstruction because the auricular tissue is the autologous donor and has a natural contour that fits the convexity of the nasal ala, and can form a nasal support frame without the need for surgery molding. The elasticity, color and texture of the graft skin match the nasal ala very well.[5]

The weakness of auricular chondrocutaneous composite graft is that the vascularization supply depends on the recipient's microcirculation. In the early stages, the composite graft receives nutrient supply by passive diffusion through the plasma imbibition process. Angiogenesis will form around the 5th day.[6] In patients who are smokers or have a history of radiation in the recipient area, or have diseases that affect microcirculation such as diabetes mellitus and peripheral arterial disease, the success of this graft is lower. Some ways to improve graft

success are the use of preoperative and postoperative steroids and the use of hyperbaric oxygen. Another way to prevent graft failure is to limit graft application to defects that are less than 1 cm in size.[5.7]

In nasal ala defects measuring more than 1 cm, it is best to combine them with other flaps that have good vascularization.[2] In 1943, Gillies described the use of a combination of flaps foreheadon auricular skin and cartilage composite graft.[4] The Paramedian forehead flap receives its vascularization mainly from the supratrochlear artery. The vascularization source of this type of flap is very rich because there is also blood flow from the supraorbital artery, infraorbital artery and branches of the facial artery.[8]

In all reported cases, the size of the nasal defect was more than 1 cm. Reconstruction of the full thickness defect. The resulting nasal will be very good using an auricular composite graft with a combination of forehead flaps. In the second case, the external nasal skin defect is quite extensive, covering the nasal dorsum, nasal tip and both nasal ala. The paramedian forehead flap approach used provides another advantage, namely the availability of large donor skin to cover the large defect in this case.

Paramedian forehead flap is the best choice for covering large nasal defects. Nasal reconstruction with this flap produces a natural nasal appearance. The skin color and texture produced by this flap most closely resemble the recipient's skin compared to other techniques. The only drawback of this flap is that it requires at least two operations.[9]

The long-term results of auricular chondrocutaneous composite grafts are quite satisfactory. The concave shape of the auricular cartilage will remain as before. The auricular cartilage in the graft does not experience or very minimal absorption, unlike what often occurs in costal cartilage grafts and bone grafts.[4]

The implications of these findings indicate that the combination of auricular chondrocutaneous composite graft and paramedian forehead flap is highly effective for nasal reconstruction, both aesthetically and functionally. This combined approach successfully covers extensive nasal defects while preserving the natural contour and achieving high graft success rates. Compared to other methods such as costal cartilage grafts, this technique demonstrates superior long-term shape stability, as auricular cartilage experiences minimal resorption—an issue frequently observed in costal cartilage grafts (Rohrich & Griffin, 2005). The inherent elasticity, texture, and color match of auricular skin closely align with nasal tissues, further enhancing reconstruction outcomes.

In contrast to commonly used techniques such as the septal chondromucosal pedicle flap or septal hinge flap, the auricular composite method offers greater versatility, especially in cases where nasal septal cartilage is compromised or unavailable (Menick, 2002). However, a significant limitation of the auricular composite graft technique is its dependence on the recipient area's microcirculation, increasing the risk of graft failure in patients with vascular impairments such as diabetes or heavy smoking (Adams et al., 2000). This underscores the necessity of thorough preoperative vascular evaluation before opting for this reconstructive method.

Overall, combining auricular composite graft with the paramedian forehead flap yields superior results compared to alternative nasal reconstruction methods reported in the literature, particularly for larger defects exceeding 1 cm. Although multiple surgical stages are required, the aesthetic outcomes considerably surpass those achieved with other techniques such as local flaps or isolated skin grafts (Burget & Menick, 1985).

Therefore, this combined approach is widely recommended for complex nasal reconstruction cases, emphasizing careful preoperative planning and meticulous risk management to ensure optimal long-term results.

CONCLUSION

In conclusion, this study highlights that the combination of auricular chondrocutaneous composite graft and paramedian forehead flap is highly effective for reconstructing extensive nasal defects after tumor excision, achieving optimal aesthetic and functional results. This technique successfully maintains robust nasal structure, symmetry, and prevents complications such as ala collapse or nostril stenosis. It is recommended that surgeons carefully evaluate the patient's vascular condition preoperatively to minimize graft failure risks, especially among patients with impaired microcirculation, including diabetics or active smokers. The implications of these findings suggest that this combined method should be considered a primary choice in clinical practice for nasal reconstruction and serve as a foundation for advancing reconstructive surgical techniques due to its demonstrated superiority over existing alternative methods.

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