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Surgical Management of Trichoepithelioma: A Case Report

Ahmad Fawzy[1], **Ismiralda Oke Putranti**[2], **Citra Primanita**[3]

[1]Department of Plastic Surgery, Faculty of Medicine University of Jenderal Soedirman - Margono Soekarjo County Hospital, Indonesia

[2]Department of Dermatology and Venereology, Faculty of Medicine University of Jenderal Soedirman - Wijayakusuma Army Hospital, Indonesia

[3]Department of Dermatology and Venereology, Margono Soekarjo County Hospital, Indonesia

ABSTRACT

Introduction: Trichoepithelioma is a rare benign tumor, predominantly found on the face and scalp, with an unclear prevalence in general population. Low incidence and lack of evidences, made trichoepithelioma management still a controversial domain in dermatology.

Case: This study presented a 31-year-old woman with extensive trichoepithelioma on her nose, who underwent surgical excision and full-thickness skin grafting

Result: Patient showed satisfaction with favorable aesthetic result and the consequent improvement in quality of her daily life.

Discussion: Nasal intricate anatomy poses specific challenges in managing tumor like trichoepithelioma, emphasizing the importance of careful surgical planning. Surgical excision, Mohs surgery, and laser ablation are viable options, while non-surgical treatments such as topical therapies and cryotherapy are effective for superficial lesions. Patient satisfaction and quality of life are essential considerations, requiring open communication and psychological support. Emerging techniques, including advanced imaging, 3D bioprinting, and targeted molecular therapies, hold promise for optimizing trichoepithelioma management. Personalized approaches based on genetic profiling and collaborative research efforts are avenues for future exploration.

Conclusion: Surgical management of trichoepithelioma on the nose, while challenging due to aesthetic concerns, can yield favorable outcomes. The approach to trichoepithelioma management should consider lesion size, surgical and non-surgical options and preference of the patient. Proper excision and meticulous skin grafting may provide aesthetically pleasant result. Personalized care, including psychological support, is crucial for post-surgery patient satisfaction. Multidisciplinary collaboration optimizes patient care in these unique cases.

KEYWORDS: Trichoepithelioma, nose, surgical excision, skin grafting, aesthetic disfigurement, patient satisfaction, multidisciplinary approach, personalized treatment.

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I. INTRODUCTION

Trichoepithelioma is a benign hair-germ tumor that most commonly arise on the face and scalp of adults. The exact incidence and prevalence of trichoepithelioma in the general population are not known, but cases are rare. Most sporadic lesions present in adults aged 40 or older although their onsets usually take place in younger ages. Brooke first described trichoepithelioma as epithelioma adenoides cysticum in 1892. In 1953, Pinkus further modified its description and then individually by Lever and Montgomery in 1967 to include embryonic origins within pluripotent hair follicle germ cells. Trichoepitheliomas are benign and rarely metastasize. However, they can transform into trichoblastic carcinoma (TBC), which arises due to the loss of p53 tumor suppressor protein and elevated PI3-AKT signaling in tumor cells.[1]

While it is typically asymptomatic and slow-growing, trichoepitheliomas located on the nose can cause aesthetic concerns and may require proper surgical management. However, low incidence and lack of enough evidences, made trichoepithelioma management a controversial domain in dermatology and dermatologic surgery.

We reported one case of a woman with trichoepithelioma covering the whole of her nose undergoing a surgical excision and skin grafting with favorable result, and presented a discussion regarding the choice of procedures and key points for successful surgical management.

II. CASE ILLUSTRATION

A 31-year old woman visited our plastic surgery clinic seeking medical help to treat her nose full of nodules and multiple papules. She said her lesions appeared around her puberty. During her physical examination, we found multiple firm skin-colored papules and nodules covering the whole nasal and some sporadic smaller lesions in the perinasal area, the medial part of the eyebrows, the peri-oral area, and some scattered on the forehead and chin area. She did not have any scalp involvements. (See **Figure 1**)

Our surgeon author diagnosed her condition as a trichoepithelioma; and after confirmative consultation to our dermatologists, we offered therapeutic choices to our patient which later she insisted to undergo the more practical surgical therapy, with consideration that non-surgical options would require her to go back and forth to the hospital while her husband could not provide time to take her for such treatment. We performed surgical excision and skin grafting for her nasal lesion and electro-dissecting for the sporadic smaller lesions. After the surgery, we continued the therapeutic program with topical Tretinoin 0,1% every night.

Figure 1. Trichoepithelioma lesions

III. RESULT

We performed surgical excision to remove the entire lesion in all anatomical units of the nose from the bridge of the nose, the lateral border of the nose and the nasal alae to the edges of the nostrils and the two nasolabial areas. We closed the post-excision defect in the nose area with a full-thickness skin graft that we took from the preclavicular area, and primary closed the post-excision defect in both nasolabial areas. We performed electrocautery for the remaining smaller and sporadic lesions.

Follow-up evaluation 1 week after surgery showed that the skin graft of the nasal area had 100% successful result and the wound in both nasolabial areas was intact with favorable scarring. Our author surgeon removed all surgical sutures without significant complications (see **Figure 2**). The remaining previously electrocautered lesions showed epithelialization but still swollen and reddish in their surroundings.

Figure 2. Follow-up evaluation at the 1st week after the surgery

The post-excision pathological examination confirmed the presence of several nodules located in the dermis, often containing small horn cysts, underdeveloped hair follicles, and calcification. These findings were observed consistently (see **Figure 3**). The connective tissue surrounding these nodules appeared denser and contained more cells. Notably, there were distinct areas with stromal cracking, resembling the appearance of the follicular bulb and papilla. Mitotic activity was observed at a low level. All those findings suggested the working diagnosis of trichoepithelioma.

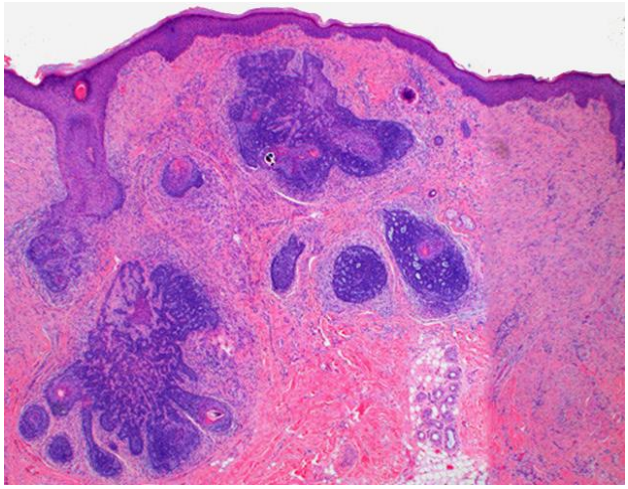

Figure 3. Pathological evaluation

Follow-up evaluation 2 months after surgery showed that the coloration of the skin graft in the nasal area improved much to resemble patient's normal skin color but a little bit darker, smooth contour of the nasal skin, all scars of the surgical area

were favorable, and the previously electrocautered lesions were well epithelialized. (See **Figure 4**). Patient were satisfied with the result, and still on follow-up care by our dermatologists.

Figure 3. Follow-up evaluation at the 2nd month after the surgery

IV. DISCUSSION

Trichoepithelioma is a rare benign skin lesion that originates from hair follicles. Trichoepitheliomas are mostly seen in the scalp, nose, forehead, and upper lip. These skin lesions originate from benign proliferation of epithelial-mesenchymal origin cells.[2-7] Trichoepitheliomas may be divided into the multiple familial trichoepithelioma, solitary trichoepithelioma and desmoplastic trichoepithelioma.[8]

Histopathologically, trichoepitheliomas contain branching nests of basaloid cells, horn cysts, and abortive hair papillae. The tumors represent benign hamartomas of the pilosebaceous apparatus.[8] In some multiple familial trichoepitheliomas structures similar to basal cell carcinoma components (BCC) may be found.[9,10]

Trichoepithelioma usually appears as multiple lesions in the autosomal dominant type,[2,5] or as an individual flesh colored papule or nodule measuring 2 to 8 mm in the sporadic type.[2,11] Due to its autosomal dominant fashion, both genders receive the gene equally, but because of lessened expressivity and penetrance in men, more commonly seen in females.[6] The gene for the development of familial trichoepithelioma encodes a tumor suppressor and links to the short arm of chromosome 9.[12] In 1996, Harada et al. reported a mutation in this tumor suppressor encoding gene located on band 9q21 in multiple familial trichoepithelioma.[13]

Regarding the nose as the site of the lesion, here are the key points to consider:

1. **Aesthetic disfigurement**: Trichoepitheliomas on the nose can be aesthetically concerning for patients due to their location on a visible and prominent facial feature. The presence of a noticeable skin lesion can cause aesthetic disfigurement and impact a person's self-esteem and quality of life. Therefore, addressing the aesthetic aspect is an important consideration in the management of trichoepithelioma of the nose.[14-16]

2. **Location-specific challenges**: The nose is a complex anatomical structure, and surgical interventions in this area require careful consideration of functional and aesthetic outcomes. The challenge lies in achieving a balance between complete tumor removal and preserving the natural contours and appearance of the nose. The proximity to vital structures, such as the nasal cartilage and nasal airways, adds an extra layer of complexity to the surgical approach.[17]

3. **Tumor size and extent**: The size and extent of the trichoepithelioma play a crucial role in determining the surgical approach. Small, superficial lesions may be amenable to less invasive techniques such as laser ablation or cryosurgery.[18,19] However, larger or deep-seated tumors may necessitate more extensive excision and possibly reconstructive procedures, such as skin grafting or local flaps, to achieve optimal aesthetic outcomes.

4. **Surgical expertise**: Given the sensitive nature of nasal surgeries, the need for precise tissue handling, and the requirement for proper aesthetic outcome, it is crucial to seek the expertise of plastic surgeons experienced in nasal reconstruction. Their knowledge of nasal anatomy, meticulous surgical techniques, and aesthetic considerations can help ensure favorable outcomes and minimize the risk of complications.

5. **Functional considerations**: While the aesthetic aspect is important, functional considerations should not be overlooked. Surgical interventions should preserve the nasal airway and maintain normal breathing function. Careful planning and execution of the procedure should take into account the potential impact on nasal airflow, structural support, and overall nasal function.[20]

6. **Patient counseling**: In cases of trichoepithelioma of the nose, comprehensive patient counseling is essential. The surgeon should discuss the treatment options, potential risks, benefits, and realistic expectations with the patient. Emphasizing the aesthetic and functional outcomes, discussing the potential need for reconstructive procedures, and addressing any concerns or anxieties can help ensure informed decision-making and patient satisfaction.

7. **Long-term follow-up**: Regular and long-term follow-up is necessary to monitor the therapeutic progress, assess the aesthetic results, and detect any signs of recurrence. Periodic evaluations can help identify potential complications early on and provide appropriate interventions if needed.

NON-SURGICAL INTERVENTIONS

Topical therapy

Topical therapies offer a non-surgical approach for the treatment of trichoepithelioma, particularly for superficial

lesions. These treatments involve the application of medications directly to the affected area. Several topical therapies have been explored for trichoepithelioma, including:

a. Topical Retinoids: Retinoids, such as tretinoin or adapalene, have been used in the management of trichoepithelioma. These medications work by promoting cellular turnover and differentiation, which can help reduce the size and visibility of the lesion. However, their efficacy may vary, and treatment duration can be prolonged.

b. Topical Imiquimod: Imiquimod is an immune response modifier that can stimulate the immune system to attack tumor cells. It has been investigated as a treatment option for trichoepithelioma. However, its use in trichoepithelioma is limited, and further research is needed to establish its effectiveness.

c. Other Topical Agents: Additional topical agents, such as 5-fluorouracil (5-FU) or photodynamic therapy (PDT), have been explored in the treatment of trichoepithelioma. 5-FU inhibits the growth of tumor cells, while PDT involves the use of a photosensitizing agent and light to destroy tumor cells selectively.

When considering topical therapies for trichoepithelioma, clinicians should take several factors into account. Topical therapies are typically most effective for superficial lesions. Deep-seated or larger tumors may not respond well to topical treatment alone.

Topical therapies have certain limitations, including variable response rates, potential side effects (e.g., skin irritation, redness), and the inability to treat deep or larger lesions effectively. Clinicians also should consider the preference of their patient, compliance, and tolerance to potential side effects. Topical therapies often require consistent and prolonged application, which may not be feasible for all patients.

The efficacy of topical therapies can vary between individuals. The response may take several weeks to months, and complete resolution may not always be achieved. Clinicians should inform their patients about the expected duration and potential need for additional treatments. Regular monitoring and follow-up visits are important to assess the response to topical therapy, monitor for side effects, and evaluate the need for additional interventions. Long-term follow-up is crucial to detect any signs of recurrence. Sometimes topical therapies need combination with other treatment modalities, such as cryotherapy or surgical excision. Combining approaches may enhance treatment outcomes and allow for a more tailored and comprehensive management plan.

CRYOTHERAPY

Cryotherapy involves the application of extreme cold temperatures to destroy abnormal or unwanted tissue. It involves the use of liquid nitrogen or another cryogen to rapidly freeze the lesion. The cryogen is applied directly to the tumor using a spray or a cryoprobe, which creates a localized freezing effect. The freezing temperature destroys the tumor cells by causing cell death and subsequent tissue necrosis. Cryotherapy has shown efficacy in the treatment of trichoepithelioma, particularly for superficial lesions. The freezing process damages the tumor cells, leading to their destruction. However, the effectiveness of cryotherapy may vary depending on the size, depth, and location of the trichoepithelioma. Superficial lesions generally respond better than deep-seated or larger tumors.

When considering cryotherapy for trichoepithelioma of the nose, clinicians should take several factors into account. Cryotherapy is typically most effective for superficial lesions with well-defined margins. It may not be as effective for deeper or larger lesions. Cryotherapy also has certain limitations, particularly for larger or deeper lesions. In such cases, surgical excision or other interventions may be necessary to achieve complete tumor removal and optimal aesthetic outcomes.

Clinicians should consider the preference of their patient, compliance, and tolerance to potential side effects. Cryotherapies often require consistency as they are typically performed in multiple treatment sessions, with intervals between sessions to allow for healing and reevaluation of the lesion. The number of sessions required may vary depending on the individual case and the response to treatment. The efficacy of cryotherapies can vary between individuals, depending on the size, depth, and location of the lesion. Superficial lesions generally respond better than deep-seated or larger tumors. Clinicians should put their patients in regular monitoring and follow-up visits to assess the response to cryotherapy, monitor for side effects (for example: pain, swelling, redness, blistering, and temporary skin discoloration at the treatment site), provide appropriate wound care instructions, and evaluate the need for additional interventions. Long-term monitoring is necessary to ensure optimal outcomes and address any concerns that may arise.

Sometimes topical therapies need combination with other treatment modalities, such as topical therapies or surgical excision. Combining approaches may enhance treatment outcomes and allow for a more tailored and comprehensive management plan.

SURGICAL INTERVENTIONS

In deeper lesions, surgical excision or other surgical interventions may be necessary for complete tumor removal and optimal aesthetic outcomes. The primary treatment for trichoepithelioma is surgical excision. This procedure involves removing the tumor and a surrounding margin of healthy tissue to ensure complete removal. Surgeons can perform surgical excision under local anesthesia in an outpatient setting. The surgical wound is then closed with sutures. However, for lesions occupying large anatomical

area, surgeons usually prefer their surgical excisions in operating room setting then close the post-excisional defects with skin grafting.

MOHS SURGERY

Mohs surgery is a specialized technique often used for the removal of skin tumors, including trichoepitheliomas. It involves removing the tumor layer by layer and examining each layer under a microscope until no tumor cells are present. This precise method ensures maximal tumor removal while preserving healthy tissue, making it particularly suitable for lesions in aesthetically sensitive areas such as the nose.

LASER ABLATION

Other surgical techniques for tirchoepitheliomas include **laser ablation** procedure. Various laser types, such as carbon dioxide (CO2) or erbium:YAG lasers, can be used to vaporize and remove the tumor while minimizing damage to surrounding tissues. Clinicians often choose laser ablation procedure for smaller lesions or those located on delicate areas such as the nose. However there also are some limitation, most noticeably the depth and size of the lesions. If the lesion extends deeper into the skin layers, the laser energy may not penetrate deep enough to target and destroy the entire tumor, potentially leading to incomplete removal. Larger lesions may require multiple treatment sessions or alternative treatment modalities due to the limited treatment area that can be covered by the laser beam during each session.

However, laser ablation, like any ablative procedure, can also result in the formation of scars. The risk of scarring in the nasal area is higher when treating trichoepitheliomas on the nose, a visible and aesthetically important area. The risk of scarring should be carefully weighed against the potential benefits of laser ablation in each individual case. Another consideration is laser treatment can cause changes in skin texture, pigmentation, or contour, which may be more noticeable on the nose due to its prominent location. Achieving a satisfactory aesthetic outcome with laser ablation alone may be challenging in certain cases. Moreover, the success of laser ablation for trichoepithelioma of the nose depends on the operator's skill and experience. Precise control of laser settings, appropriate selection of laser type and parameters, and proper technique are crucial for achieving optimal outcomes.

Individual patient factors, such as skin type, medical history, and personal preferences, should be taken into account when considering laser ablation as a treatment option. Some patients may have contraindications to laser therapy or may prefer alternative approaches due to the risk of scarring or other concerns. Trichoepithelioma itself has a tendency to recur, and laser ablation may not always provide a permanent solution. Incomplete removal of the tumor or the presence of residual cells can lead to recurrence. Regular monitoring and follow-up are necessary to detect any signs of recurrence and provide timely interventions if needed.

In some cases, laser ablation may be used in combination with other treatment modalities, such as surgical excision or cryotherapy, to optimize treatment outcomes. Combining approaches may be necessary to achieve complete tumor removal and improve aesthetic results.

SKIN GRAFTING

Skin grafting is a common technique in plastic surgery used to reconstruct skin tissue loss caused by trauma, surgery, or disease. In the context of post-excisional skin defects in the nasal area, the goal is to restore both the functional and aesthetic aspects of the nose.

Skin grafting for post-excisional skin defects in the nasal area is indicated when there is a significant loss of skin tissue following surgical excision of skin lesions, trauma, or skin cancer removal which cannot undergo complete spontaneous closure within a duration of 28 days or will not give ideal aesthetic results if allowed to close spontaneously within 28 days. Patients with good overall health, appropriate wound healing capacity, and realistic expectations for outcomes are suitable candidates. Factors such as the patient's age, smoking history, medical comorbidities, and the location and size of the defect should be considered during patient selection.

The nose itself can be divided into anatomical units and sub-units (see **Figure 4**), including the nasal tip, dorsum, sidewalls, alae, and columella. These sub-units have distinct characteristics, including skin texture, thickness, and color, which should be carefully considered to achieve optimal aesthetic outcomes. In term of reconstruction, plastic surgeons often perform excision as accordingly to the anatomical sub-unit area, with consideration of avoiding mismatch of skin color nor irregularity of countour in the same anatomical sub-unit.

As the nasal area is part of the facial area, the choice of skin graft type is crucial for achieving good aesthetic results. For smaller defects or defects on areas where the contour is notched or curved, surgeons utilize split-thickness skin grafts (STSG) due to their pliability and ability to conform to complex contours. When dealing with larger defects or ones that occupy the whole anatomical sub-unit, plastic surgeons usually prefer full-thickness skin grafts (FTSG) which can provide more durability and better aesthetic outcomes. Full-thickness skin grafts are typically harvested from a donor site with similar skin characteristics. For any defect on the facial region like the nose, surgeons prefer harvesting the graft from the retroauricular area or the supraclavicular region. Proper preparation of the full-thickness skin graft involves removing excess fat and subcutaneous tissue to ensure optimal graft adherence. Careful handling and storage of the graft are essential to maintain its viability.

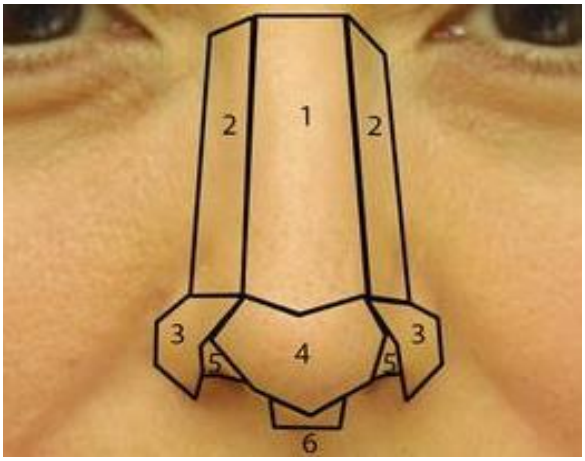

Figure 4. The anatomical unit and sub-units of the nose

After performing the excision, our surgeon author meticulously prepared the recipient site, ensuring that the wound bed is free from active bleeding, potential infection, and devitalized tissue. Skin graft survival depends on multiple factors, including graft thickness, proper wound bed preparation, and meticulous surgical technique. In the nasal area, grafts tend to have relatively high survival rates due to the rich blood supply. However, some minor loss of graft tissue is not uncommon. To anticipate such risk, our author surgeon also employed "pie-crusting" method and anchoring sutures after the harvested full-thickness skin graft was placed and securely sutured for better graft contouring and minimize graft contracture.

Complications associated with skin grafting in the nasal area may include graft failure, graft contracture, infection, hypertrophic scarring, color mismatch, and contour irregularities. Proper wound care, antibiotics when indicated, and close postoperative follow-up are essential to monitor graft healing and manage any complications that may arise.

For our patient, we performed surgical excision to remove the entire lesion in all anatomical units of the nose from the bridge of the nose, the lateral border of the nose and the nasal alae to the edges of the nostrils and the two nasolabial areas. We closed the post-excision defect in the nose area with a full-thickness skin graft that we took from the preclavicular area, and primary closed the post-excision defect in both nasolabial areas. We performed electrocautery for the remaining smaller and sporadic lesions. Our patient showed the anticipated full-thickness skin graft contraction which was still more favorable compared to a stronger split-thickness skin graft contraction and affected only a slight change in her nasal anatomical structure in form of shortened alar base and triangular-shaped nostrils (see **Figure 5**). However, our patient explained that such minor matter did not interfere with or reduce her satisfaction with the surgery results and the much improvement in the quality of her daily life.

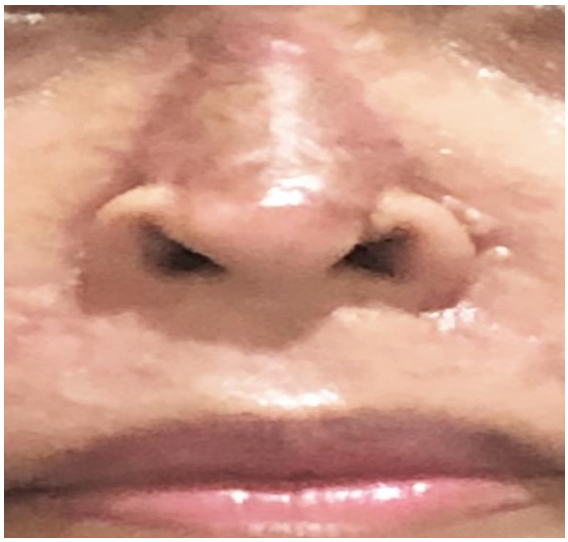

Figure 5. Contraction of the grafted skin on the nose affected a slight change in anatomical structure in form of shortened alar base and triangular-shaped nostrils

COMPLICATIONS AND MANAGEMENT

Immediate complications following surgical interventions for trichoepithelioma of the nose may include bleeding, hematoma formation, or infection. Prompt identification and management are vital to mitigate these issues. We performed adequate hemostasis during surgery and meticulous wound closure to minimize the risk of immediate complications. Considering the risk of infection, we assessed clinical appearance regularly during her post-surgical visits, and provided antimicrobial topical therapy.

Delayed complications are also noteworthy, with scarring and wound healing concerns being the most notable. Tumor excisions on the nose often result in visible scars that may affect the aesthetic outcome. Techniques like proper wound closure and the use of sutures designed to minimize scarring can be beneficial. We assigned regular follow-up appointments to monitor the progress of the wound healing and to intervene promptly if abnormal healing patterns, such as hypertrophic or keloid scarring, emerge. Furthermore, our team educated our patient about proper wound hygiene and

the avoidance of sun exposure. By addressing those immediate and delayed complications proactively, clinicians can enhance both the aesthetic and functional outcomes in trichoepithelioma cases and improve patient satisfaction.

PATIENT SATISFACTION AND QUALITY OF LIFE

Patient satisfaction and quality of life following surgical interventions for trichoepithelioma are multifaceted considerations that merit in-depth attention. Surgical excision of trichoepithelioma on the facial area, especially in aesthetically important areas like the nose, can significantly impact patient satisfaction with the outcome. Achieving not only tumor eradication but also optimal aesthetic results is paramount. Patients often have high expectations regarding post-surgical appearance, given the prominence of facial features. Hence, effective communication between the healthcare provider and the patient during preoperative counseling is crucial. We inform our patient about the expected surgical outcome, potential scarring especially along the skin graft edges and the nasolabial lines which were planned for primary closure, and the possibility of multiple procedures. Establishing realistic expectations helps mitigate pot-surgical dissatisfaction.

Quality of life assessments after the surgery of trichoepithelioma encompass both physical and psychological domains. While successful surgery can lead to improved self-esteem and overall well-being by removing the visible lesion, plastic surgeons should acknowledge that surgical interventions can also induce temporary emotional distress. Patients may experience anxiety or depression related to their appearance, particularly during the initial healing phase when swelling, redness, or scarring may be more pronounced. Thus, providing psychological support and counseling as an integral part of the postoperative care plan is vital. We encouraged our patient to express her concern during her follow-up visit, and offered positive words of support as an act of significant contribution to her post-surgical satisfaction and quality of life.

FUTURE PERSPECTIVES AND EMERGING TECHNIQUES

In the realm of trichoepithelioma management, exciting advancements are on the horizon. One notable area of progress is the refinement of surgical techniques. Emerging technologies, such as computer-assisted surgical navigation and advanced imaging modalities, are enhancing precision in excision procedures. These tools aid in achieving complete tumor removal while preserving surrounding healthy tissue, particularly in intricate areas like the nose. Moreover, innovative tissue-engineering approaches, like 3D bioprinting, show promise for reconstructive procedures after trichoepithelioma removal, potentially offering more natural and aesthetically satisfying outcomes.

Furthermore, novel therapeutic options are under investigation. Targeted molecular therapies and immunotherapies are being explored to selectively target trichoepithelioma cells while minimizing collateral damage. These therapies hold the potential to improve treatment efficacy and reduce adverse effects. Additionally, advances in photodynamic therapy and laser technologies continue to evolve, offering more precise and less invasive alternatives for trichoepithelioma management. As we move forward, further research efforts should focus on refining patient stratification based on genetic and molecular profiling, enabling personalized treatment approaches. Collaborative studies and multicenter trials are essential for robust data collection and validation of emerging therapies, ultimately enhancing our ability to optimize outcomes for patients with trichoepithelioma.

CONCLUSION

Trichoepithelioma is a benign tumor commonly found on the face and scalp of adults, and its exact prevalence remains uncertain due to its rarity. Surgical management of trichoepithelioma, especially on the nose, can be challenging due to its potential for aesthetic concerns. In this case study, a 31-year-old woman with trichoepithelioma covering her entire nose underwent surgical excision and skin grafting. The surgical procedure involved removing the entire lesion on the nose and closing the defect with a full-thickness skin graft. Electrocautery was performed for smaller lesions. The skin graft exhibited a favorable result with minimal aesthetic impact on the nasal anatomical structure.

Trichoepithelioma management on the nose entails addressing aesthetic disfigurement, considering location-specific challenges, and tailoring the surgical approach to lesion size and extent. Clinicians should always consider surgical excision among the treatment modalities, and techniques like Mohs surgery and laser ablation are viable options. Non-surgical treatments, including topical therapies and cryotherapy, are effective for superficial lesions but may have limitations for deeper or larger tumors. Achieving patient satisfaction and quality of life post-surgery requires managing expectations and offering psychological support. Emerging techniques include advanced imaging, 3D bioprinting for reconstruction, targeted molecular therapies, immunotherapies, and evolving laser technologies, promising improved outcomes for trichoepithelioma management.

It is important to remember that each case of trichoepithelioma of the nose is unique, and the management approach should be tailored to the individual patient's needs and characteristics. A multidisciplinary approach involving dermatologists, plastic surgeons, and other healthcare professionals can optimize patient care and outcomes.

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