

Reconstructive challenges of sinonasal tumors: A case report

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Received November 30, 2021; Accepted December 30, 2021

DOI: 10.3892/etm.2022.11346

Abstract. Sinonasal tumors are an uncommon pathological entity and applying the optimal treatment may represent a challenge, even for experienced physicians. A various number of techniques and materials may be used in the reconstruction of craniofacial defects following surgery for extensive sinonasal cancer. The aim of the present study was to present the case of a 33-year-old male patient diagnosed with a large sinonasal tumor and discuss the challenges faced while selecting the most suitable rehabilitation technique. In the present case, it was decided that the optimal solution was to use a craniofacial prosthesis in order to cover the entire defect, as well as a temporoparietal flap. In summary, reconstructive interventions must always be adapted to each individual patient and a multimodal approach may lead to a highly satisfactory outcome, for both the patient and the surgical team. All the reconstructive solutions available must always be kept in mind and adapted to the individual requirements of each case, taking into consideration both the extent of the tumor and the comorbidities of the patient, as there is no one solution that is considered as optimal for all patients.

Introduction

Sinonasal tumors are a rare pathological entity, representing ~3% of upper respiratory tract tumors and being characterized by marked anatomopathological diversity (1). The affected areas include the nasal cavity and the paranasal sinuses and, in advanced cases, the tumors may extend to involve the surrounding anatomical structures, with no significant clinical symptoms until late in the course of the disease (2,3). Their proximity to vital structures, such as the optic nerves and brain, poses a challenge for surgeons when proceeding with reconstructive treatment. The common extension areas for this type of tumor are the cribriform plate, crista galli and the roof of the ethmoid, the orbit and, occasionally, the facial soft tissues (4). Performing an extensive resection of the tumor with clear margins may result in sizeable cranial and facial skin defects, which must then be covered with the aid of a multidisciplinary team (5).

Currently, the improved craniofacial surgical techniques, the advanced technology and equipment, high-quality imaging and good interdisciplinary management may improve the appearance of the face after surgery (6).

The main purpose of an efficient obstructive prosthesis for a patient who has had the hard palate removed is to create a barrier between the nasal cavity and the mouth, maintaining good speaking and swallowing functions (4,6,7). The defect can be repaired by using skin grafts, bone grafts, flaps and even facial prostheses, in order to achieve satisfactory functional and aesthetic results (4,7). The prostheses are designed and adjusted by a maxillofacial prosthodontist, who is trained to construct devices that replace the anatomical structures of the head and neck, including those in the oral cavity, adapted to the requirements of each patient (8).

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Key words: sinonasal tumors, reconstructive, prosthesis, challenges, surgical approach

Case report

We herein present the case of a 33-year-old male patient, with no significant comorbidities, who was diagnosed with sino-nasal carcinoma treated with radical surgery in 2019 followed by radiotherapy treatment, who required a complex surgical approach and facial reconstruction.

This patient was admitted to the Department of Otorhinolaryngology and Head and Neck Surgery from 'Sf. Spiridon' Clinical Hospital in September 2019 with complains of left hemicrania, left nasal obstruction, left reflex otalgia, left clear rhinorrhea and recurrent left epistaxis. These symptoms had worsened during the last 5 months prior to hospitalization, with no improvement following medical treatment for maxillary sinusitis. Clinical examination at this stage revealed the following: Left exophthalmia, and a tumor of reddish color and soft consistency that occupied the entire left nasal cavity and was associated with an extensive swelling in the left maxilla.

Another CT scan was performed followed by cranial MRI examination that showed a large irregular tumor mass with heterogeneous density filling the left nasal cavity and involving the left paranasal sinuses. An expansive osteolytic bone destruction pattern was observed in the ethmoid bone, medial and lateral walls of the left maxillary sinus and orbital floor. Left obstructive sinusitis and left exophthalmia were also present. The lesion was isointense on T1 weighted images and exhibited mild hypointensity on T2 weighted images (Fig. 1). There was no evidence of metastasis on the total body scan.

The clinical diagnosis was a malignant tumor of unknown type. A biopsy was performed, along with histopathological examination, which concluded that the tumor was a sarcoma composed of fusiform cells arranged in long intersected, irregular fascicles. Tumoral proliferation with moderate cellularity was observed, with non-homogeneous chromatin, elongated nuclei, some nucleoli, with a homogeneous, moderately pleomorphic cell population (9). Moderate mitotic activity was observed, with no tumor necrosis, and a Ki-67 index of 50%.

The final diagnosis of grade 2 fibrosarcoma [score 3 according to the Fédération Nationale des Centres de Lutte Contre Le Cancer (10)] was based on the clinical, radiographic and histopathological characteristics and immunohistochemistry examinations (smooth muscle actin was negative in the tumor cells and positive in the vascular walls; S100 was negative in the tumor cells and positive in the nerve fibers of the mucosal chorion; CD34 was negative in tumor cells and positive in the endothelial cells of intratumoral capillaries; CKAE1/3 was negative in the tumor cells and positive in the mucosa and glands of the chorion; and vimentin was positive in the tumor cells). The stage was T4N0M0 and the treatment of choice was extended surgical resection with facial reconstruction and radiotherapy.

The surgical strategy included radical maxillectomy of the left side with removal of the left inferior orbital wall and left nasal cavity, as well as left-side ethmoidectomy, in order to ensure clear tumor resection margins (Fig. 2).

The inferior orbital wall was replaced by a titanium mesh and a temporoparietal fascial flap was used to cover it, elevated and transposed to the orbit through a subcutaneous tunnel. An acrylic obturator prosthesis was especially designed and adapted to the patient's postoperative defect.

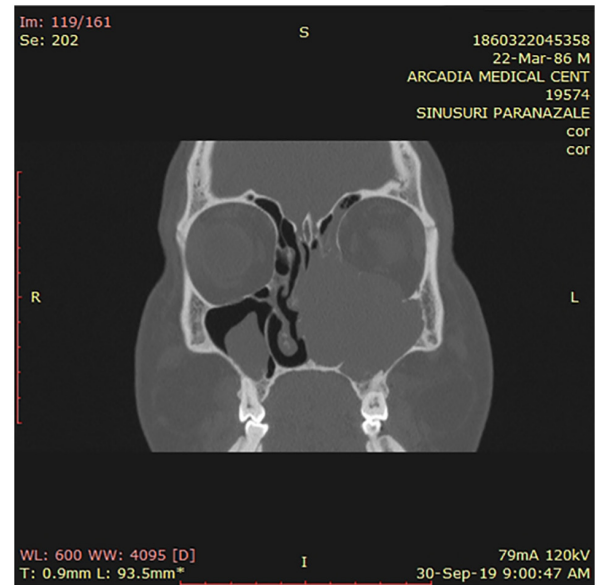


Figure 1. Paranasal CT prior to surgery revealed the presence of a mass in the left maxillary and ethmoidal sinuses, bone destruction of the orbital floor, nasal septum and the medial, anterior and inferior wall of the left maxillary sinus.



Figure 2. Intraoperative view of the exposed tumor.

Resection of the cervical lymph nodes in this case was not deemed necessary.

Postoperatively, the patient underwent radiotherapy treatment with Cobalt-60 using a linear accelerator at a total dose of 50 Gy divided into 1.8-2 Gy per cycle of treatment over 5 weeks, with good preservation of the covering flap. The patient experienced no major side effects after the radiotherapy.

The patient was able to speak, eat and chew without any problems after 5 days. In addition, there were no difficulties with swallowing. The prosthesis allowed the patient to lead a normal life. He was satisfied with the postoperative cosmetic result and had no social problems or other complaints.

Control assessments were performed at 6 and 12 months postoperatively, showing no evidence of locoregional recurrence, systemic metastases or distant complications. The last



Figure 3. Postoperative clinical aspect.

check-up was in May 2021, revealing a good outcome for the patient.

This procedure achieved optimal reconstruction of the anterior wall of the left maxillary sinus and inferior orbital wall. Moreover, it has greatly improved the aesthetic postoperative outcomes (Fig. 3).

Discussion

Sinonasal fibrosarcoma is a rare malignant tumor, with only 1% of fibrosarcomas occurring in the head and neck region, whereas the majority are found at the extremities (11). Final diagnosis and staging are based on histopathology, immunohistochemistry examination and on the imaging evaluation (12).

Sinonasal fibrosarcomas are associated with a high risk of local recurrence, but a low risk of distant metastasis (12,13). The indicated treatment with the best results is complete surgical resection of the tumor followed by reconstruction and combined with postoperative radiotherapy (11,12).

The biggest challenge of sinonasal reconstruction is to repair a complex three-dimensional structure, with the varying thickness of the tissue covering it, to restore its function and aesthetic appearance to the greatest possible extent (14) and to achieve facial symmetry with a good aesthetic outcome (15). The prosthesis should provide a natural look adapted to the patient's physiognomy, with no visible defects or scars (16), and with minimal risk of complications. The local flap alone may not be able to fully reestablish all the essential functions.

Particular cases, such as the present, highlight the dilemma when selecting the appropriate method of reconstruction for a young patient with a sizeable facial defect that may result after radical surgery, which must be resolved to the greatest possible extent. The combination of craniofacial prosthetic techniques with temporoparietal flaps has been proven to be a successful technique (17,18). However, this method may not be suitable for all patients undergoing sinonasal cancer surgery, as sometimes a simple flap alone may be a better option (for example, in elderly patients or those who cannot adapt or do not have the ability to remove the prosthesis) (19). Furthermore, certain activities, such as speaking and swallowing, may be

more difficult with a flap than with an obturator prosthesis alone (20).

The reconstruction of the orbital floor is another complex issue after an extensive surgical resection. It is important to maintain the orbital contents in place, to prevent a later dystopia, diplopia or the risk of a non-functional eye (21). There must be enough soft tissue coverage of the bone or titanium mesh, complete isolation of sinonasal structures and an adequate orbital cavity depth in order to achieve a realistic appearance and facial symmetry (19,22).

Another crucial factor that can change the reconstructive strategy is the patient's history. For those with a history of diabetes and tobacco use, there is a higher risk of skin necrosis, which may require adaptation of the approach (5). In addition, the patient's expectations and facial features may change the surgeon's perspective. For example, older patients may not have the same appearance expectations and tissue availability as younger patients (23). In order to achieve superior aesthetic and functional results, a local flap with appropriate tissue donor sources (14) associated to an obturator prosthesis and a multi-level reconstructive method may be the most viable option (22). The location, size and depth of the surgical defect, and also adapting the technique to the patient's particularities and needs, represent important variables in this field (20). Moreover, it is mandatory to ensure good postoperative care and follow-up in order to optimize the final result. A compliant and well-informed patient regarding the importance of postoperative care may significantly improve the final cosmetic result (8).

Due to the complexity of the facial structures and the surgical approach, the multidisciplinary team working on the case must be experienced enough to elaborate the entire treatment plan, to manage any potential intraoperative complications (for example, the craniofacial area is highly vascular and there is a high risk of hemorrhage, a large residual defect may be left after resection, nerve injury may occur, etc.), as well as postoperative complications. The nutritional status (24) is crucial for the healing process (25,26), as the survival of the flap depends on both the vascular supply and the local defense mechanisms. In addition, all the steps involved in the management process must be thoroughly explained to the patients, including surgery and adjuvant therapy, to ensure proper compliance to treatment (27), which may result in an improved overall outcome.

In the present case, the patient was young, with no remarkable medical history, and this allowed us to employ a multimodal reconstructive technique with better functional outcomes compared with either flap reconstruction or prosthesis alone. Good communication and patient compliance were established early during this process, which was also an important factor that allowed us to implement improved solutions.

Overall, the management of large craniofacial defects after advanced sinonasal cancer resection represents an important challenge for the majority of surgeons. In order to achieve satisfactory results, it is important to adapt the technique to each patient's particularities, cosmetic expectations, age and prognosis, while preserving vital functions. On the other hand, these challenges allow us to implement improved reconstructive techniques and methods, striving to preserve the patient's quality of life to the greatest extent possible.

Acknowledgements

Not applicable.

Funding

No funding was received.

Availability of data and materials

The data presented and/or analysed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

All authors contributed to the acquisition of the data and critical revision of manuscript for important intellectual content. DOP and FA were responsible for the research design and manuscript drafting. CP and MP were responsible for language editing. VC and VA were responsible for editing the article and photos. PZ contributed to the literature data analysis and the critical interpretation and FM was a major contributor to the writing of the manuscript. RH has reviewed the manuscript. DOP and PZ confirm the authenticity of the raw data. All authors read and approved the final version of the manuscript.

Ethics approval and consent to participate

Not applicable.

Patient consent for publication

Signed written consent form was obtained from the patient regarding the publication of the case details and associated images.

Competing interests

All the authors declare that they have no competing interests.

References

- Banuchi V, Mallen J and Kraus D: Cancers of the nose, sinus, and skull base. *Surg Oncol Clin N Am* 24: 563-577, 2015.
- Haerle SK, Gullane PJ, Witterick IJ, Zweifel C and Gentili F: Sinonasal carcinomas: Epidemiology, pathology, and management. *Neurosurg Clin N Am* 24: 39-49, 2013.
- Kauke M, Safi AF, Grandoch A, Nickenig HJ, Zöller J and Kreppel M: Sarcomas of the sinonasal tract. *Head Neck* 40: 1279-1286, 2018.
- Suárez C, Ferlito A, Lund VJ, Silver CE, Fagan JJ, Rodrigo JP, Llorente JL, Cantù G, Politi M, Wei WI and Rinaldo A: Management of the orbit in malignant sinonasal tumors. *Head Neck* 30: 242-250, 2008.
- Na'ara S, Mukherjee A, Billan S and Gil Z: Contemporary multidisciplinary management of sinonasal mucosal melanoma. *Onco Targets Ther* 13: 2289-2298, 2020.
- Eskander A, Kang SY, Teknos TN and Old MO: Advances in midface reconstruction: Beyond the reconstructive ladder. *Curr Opin Otolaryngol Head Neck Surg* 25: 422-430, 2017.
- Mello MC, Piras JA, Takimoto RM, Cervantes O, Abraão M and Dib LL: Facial reconstruction with a bone-anchored prosthesis following destructive cancer surgery. *Oncol Lett* 4: 682-684, 2012.
- Paprocki GJ: Maxillofacial prosthetics: History to modern applications. Part 1-obturator. *Compend Contin Educ Dent* 34: e84-e86, 2013.
- Stanciu AE, Zamfir-Chiru-Anton A, Stanciu MM, Pantea Stoian A, Jinga V, Nitipir C, Bucur A, Pituru TS, Arsene AL, Dragoi CM, *et al*: Clinical significance of serum melatonin in predicting the severity of oral squamous cell carcinoma. *Oncol Lett* 19: 1537-1543, 2020.
- National Cancer Institute (NCI): PDQ Cancer Information Summaries [Internet]. NCI, Bethesda, MD, 2022.
- Patel TD, Carniol ET, Vázquez A, Baredes S, Liu JK and Eloy JA: Sinonasal fibrosarcoma: Analysis of the surveillance, epidemiology, and end results database. *Int Forum Allergy Rhinol* 6: 201-205, 2016.
- Ekinci A, Karataş D, Yetiş A, Erenler BH and Özcan M: Destructive fibrosarcoma of the maxillary sinus. *J Craniofac Surg* 29: e226-e228, 2018.
- Plaza G, Ferrando J and Pinedo F: Sinonasal fibrosarcoma: A case report. *Eur Arch Otorhinolaryngol* 263: 641-643, 2006.
- Gentile P, Nicoli F, Caruso R, Gravante G and Cervelli V: Alternative strategy to reconstruct the nose after excision: Extra-oral implant anchored to bone. *Br J Oral Maxillofac Surg* 47: 50-51, 2009.
- Summers BK and Siegle RJ: Facial cutaneous reconstructive surgery: Facial flaps. *J Am Acad Dermatol* 29: 917-944, 1993.
- Little SC, Hughley BB and Park SS: Complications with forehead flaps in nasal reconstruction. *Laryngoscope* 119: 1093-1099, 2009.
- Kim JYS, Buck DW II, Johnson SA and Butler CE: The Temporoparietal fascial flap is an alternative to free flaps for orbitomaxillary reconstruction. *Plast Reconstr Surg* 126: 880-888, 2010.
- Hu S, Arnaoutakis D, Kadakia S, Vest A, Sawhney R and Ducic Y: Osseointegrated implants and prosthetic reconstruction following skull base surgery. *Semin Plast Surg* 31: 214-221, 2017.
- Ali MM, Khalifa N and Alhaji MN: Quality of life and problems associated with obturators of patients with maxillectomies. *Head Face Med* 14: 2, 2018.
- Hoasjoe DK, Stucker FJ and Aarstad RF: Aesthetic and anatomic considerations for nasal reconstruction. *Facial Plast Surg* 10: 317-321, 1994.
- Santamaria E and Cordeiro PG: Reconstruction of maxillectomy and midfacial defects with free tissue transfer. *J Surg Oncol* 94: 522-531, 2006.
- Gliklich RE, Rounds MF, Cheney ML and Varvares MA: Combining free flap reconstruction and craniofacial prosthetic technique for orbit, scalp, and temporal defects. *Laryngoscope* 108: 482-487, 1998.
- Burget GC and Menick FJ: The subunit principle in nasal reconstruction. *Plast Reconstr Surg* 76: 239-247, 1985.
- Nitipir C, Diaconu CC, Orlov C, Pantea Stoian A, Hainarosie R, Slavu I, Suceveanu AI, Pituru A and Popa AM: The necessity of nutritional intervention in the oncological patient. What is the evidence? Conference: 35th Balkan Medical Week on Healthy Ageing-An Endless Challenge, Proceedings of The 35th Balkan Medical Week, pp133-137, 2018.
- Drăgoi CM, Moroşan E, Dumitrescu IB, Nicolae AC, Arsene AL, Drăgănescu D, Lupuliasa D, Ioniţă AC, Pantea Stoian A, Nicolae C, *et al*: Insight into chrononutrition: The innermost interplay amongst nutrition, metabolism and the circadian clock, in the context of epigenetic reprogramming. *Farmacia* 67: 557-571, 2019.
- Rahnea-Nita G, Ciuhu AN, Pantea-Stoian AM, Nitipir C, Popescu M, Badiu DC, Andronache LF, Mandu M and Rahnea-Nita RA: Assessment of cachexia in cancer patients with advanced disease. In: Proceedings of the 3rd International Conference on Interdisciplinary Management of Diabetes Mellitus and its Complications (INTERDIAB). INTERDIAB, Bucharest, pp139-147, 2017.
- Țanțu MM, Stan GM, Rogozea L, Păunescu A, Pleșa CF, Nemeș RM, Nicolae C and Bisoc A: Drug use, a valid indicator for effective implementation of medical protocols. *Revista de Chimie-Bucharest-Original Edition* 70: 859-862, 2019.



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