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Case study

Sinonasal outcome after endoscopic monostril transsphenoidal surgery: A single center cohort study

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ABSTRACT

Objective: The endoscopic endonasal approach has been well established for skull base surgery. However, there are only few studies pointing out nasal complaints after surgery. In this study, the authors evaluated postoperative nasal complaints and complications after monostril endoscopic procedures.

Methods: All patients operated on parasellar and sellar pathologies at our department via an endoscopic monostril transnasal transsphenoidal approach from January 2011 to May 2015 were analyzed. To assess specific postoperative nasal pathological conditions and complaints, a questionnaire was established. Applicable data of 79 patients with additional ENT follow-up could be included. Endpoints were the quantitative evaluation of complications and correlation of these data.

Results: There was no vascular injury or worsening of visual function. Two patients had persisting CSF fistula and one of them meningitis. There was a significant decrease of nasal complaints during follow up after 2 years ($p < 0.001$). Further surgical treatment by ENT physician was necessary in 11.4%. Resurgery significantly increased the risk of postsurgical complaints ($p < 0.005$). The use of a tamponade significantly reduced the risk of postsurgical reduced nasal airflow ($p = 0.026$) and sinusitis ($p = 0.002$).

Conclusions: Endoscopic endonasal procedures to skull base lesions achieve high radicality with low complication rates. However, they induce temporary and permanent nasal complaints and complications. Thereby, resurgeries increase the risk of nasal complaints and the use of nasal tamponades might increase the sinonasal outcome. Further prospective studies are necessary to objectify the evaluation of postsurgical nasal complications.

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1. Introduction

Treatment strategy and surgical technique in patients suffering from sellar and parasellar lesions have undergone significant evolution over the last decades. The transsphenoidal microsurgical approach [1–7], which was investigated and further established over almost a century of continuous research, represented the “gold standard” for surgical treatment of sellar lesions. Since the last two decades, the endoscopic technique has increasingly been used for skull base surgery [8–16]. Numerous reports on endonasal

endoscopic surgery have stressed the less invasive nature of this technique yet accompanied by high radicality rates [8,11,13,17–19]. This surgical corridor also allows for approaching the anterior skull base or the clivus [20] and the brainstem [21]. With increasing experience, neurosurgeons access more challenging pathologies using the endoscopic transnasal route [11,12,21–24]. Consequently, the standard transsphenoidal endoscopic approach has been used and modified by many endoscopic skull base surgeons to develop an optimal technique to reach the sellar and perisellar regions [25–33]. Thus, attention was mainly focused on feasibility and surgical results while neglecting potential complications. There is scarcity of current literature dealing with the impact of endoscopic transnasal transsphenoidal surgery on sino-nasal morbidities and postoperative olfactory performance. Cerebrospinal fluid leaks, vascular injury, visual impairment and postoperative hypopituitarism require careful consideration when operating via the transnasal transsphenoidal route [10,34]. Impairment of quality of life owing to nasal complaints or complications following endoscopic transnasal transsphenoidal surgery has

Abbreviations: ACTH, adrenocorticotropic hormone; AIDA, Advanced Image and Data Acquisition; CSF, cerebrospinal fluid; CT, computer tomography; ENT, ear, nose, throat; FSH, follicle stimulating hormone; GH, growth hormone; GTR, gross-total resection; ICA, internal carotid artery; IGF-1, Insulin-like growth factor; LH, luteinizing hormone; MRI, magnetic resonance imaging; NTR, near-total resection; SD, standard deviation.

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rarely been reported. Nonetheless, many reports portray the quality of life after sinus surgery for chronic rhinosinusitis [35–37] and thus allow hypothesizing similar sequela.

In light of these aspects, the authors sought to examine the prevalence and risk factors for sinonasal complaints and complications after endoscopic mono-nostril transsphenoidal skull surgery of the skull base.

2. Material and methods

2.1. Study design, data collection and patient evaluation

The authors analyzed all patients that underwent endoscopic mono-nostril transsphenoidal surgery between January 2011 and May 2015 at the Department of Neurosurgery at Saarland University Hospital. Patients undergoing endoscopic mono-nostril transsphenoidal surgery were prospectively recorded including baseline demographics, history, symptoms, neurological deficits, clinical visits, imaging studies, data on tumor characteristics, intraoperative and postoperative complications as well as surgical outcome. Those patients with both routine neurosurgical and ENT follow-up were considered eligible for further analysis.

A dichotomous questionnaire (Y/N) comprehensively assessing specific postoperative sino-nasal complaints and complications was compiled based on the author's expertise. The questionnaire asked for presence of nasal pain, decrease of nasal airflow, alteration of olfactory performance, reduction of taste sensitivity, fetidness of the nose, nasal bleeding, history of sinusitis, synechia, septum perforation, doughier nasal mucosa, changes of nasal aesthetics, paranaesthesia of nose or upper lip, necessity for further ENT treatment and ENT surgery (questionnaire is provided in [Supplementary materials](#)). Patients were contacted postally asking for their contribution.

After first analysis, these patients reporting nasal complaints were separately interviewed again, subsequently in detail concerning the progress of nasal complaints during follow-up.

The study and patient assessment were authorized by the ethical committee of the Saarland medical council (No. 186/15).

2.2. Surgical procedure

All surgical procedures were done by the first and senior author of this manuscript as previously described [11,14]: All surgeries were performed under general anaesthesia with orotracheal intubation. The patient was maintained supine with the upper part of the body slightly elevated to about 20° and the fixed head tilted to the left. Lateral fluoroscopy (C-arm) was routinely used for intraoperative imaging additionally to MRI- or CT-based neuronavigation. The nasal cavities were prepared with an alcohol based disinfectant (Octenisept®). Mepivacaine with 1:100000 adrenaline soaked cotton was placed into bilateral nasal cavities for local haemostasis. After selection of the nostril, the speculum is carefully inserted under direct endoscopic control until it reaches the middle turbinate. The authors preferred the right nostril for their approach. However, in some cases the left nostril was used because of very narrow right nostril or right sided far lateral tumor behind the right internal carotid artery. It is further advanced passing the inferomedial aspect of the middle turbinate under lateral fluoroscopy to the sellar floor until the sphenoid sinus is reached. The nose is carefully dilated in several steps. With the use of the speculum, the nasal mucosa can be preserved through the whole surgical procedure and almost any mucosal bleeding can be prevented. The sphenoid ostium is localized at the recessus sphenothmoidus. The septal mucosa is coagulated, incised and mobilised to the side with the microdissector. Then the nasal septum is broken directly at the sphenoid floor pushing the speculum

against the septum. The speculum usually stays directly at the sphenoid floor by itself. Then the sphenoid floor is removed. At the end of the procedure, the nasal septum is pushed back in its normal midline position by the small finger forwarded deeply into the other nostril. The nasal mucosa is put back over the sphenoid opening. The speculum is removed, and a final inspection is performed with the 0° optic. Nasal packing was used based on surgeon's decision. The different steps of the endonasal approach are demonstrated in [Fig. 2](#).

For surgery, 4 mm or 2.7 mm rigid endoscopes with Hopkins optics and 0°-angled lenses were used for the approach and subsequent tumor removal. Scopes with 30°- and 70°-angled lenses were employed for final inspection to improve radicality as well as for tumor resection. All equipment was provided by Karl Storz Company, Tuttlingen, Germany. In all cases of intraoperative CSF leakage dural closure was performed in sandwich technique with an autologous periumbilical fat graft in underlay technique, Tachosil or fascia lata and fibrin glue or FlowSeal. Additionally, a lumbar drainage was inserted at the end of the procedure in these cases. The skull base defect was reconstructed with bone pieces and the sphenoid cavity was filled with a layer of fibrin glue and Tachosil. All procedures were video recorded. The surgical technique was carefully analysed.

2.3. Clinical outcome and follow-up

Complications were analysed based on the operation report, video recording, medical report, the postoperative imaging and follow-up. To evaluate hypopituitarism and remission in case of secreting adenomas, the patient's pituitary function was assessed using serologic testing of hormone levels of morning cortisol, ACTH, TSH, GH, IGF-1, LH, FSH and prolactin both pre- and postoperatively. Additionally, urine specific gravity was routinely analyzed after surgery. To evaluate visual function, all patients with perisellar and sellar lesions in contact with the optic chiasma underwent ophthalmological evaluation including visual field testing.

Routinely, neurosurgical outpatient evaluation was performed at Saarland University Hospital. A tumor recurrence was defined as new evidence of tumor in MR imaging studies after previous gross total resection, or in case of newly developed hormonal imbalance not attributable to other endocrinological conditions.

ENT follow-up was performed at the ENT outpatient clinic of the Saarland University Hospital and other affiliated ENT outpatient clinics. In case of any sinonasal complaint, patients were routinely administered to an affiliated ENT outpatient clinic.

Surgical radicality was assessed via postoperative MR imaging. Alteration of neurological deficits and any complication were recorded. Special attention was paid to surgical radicality assessed

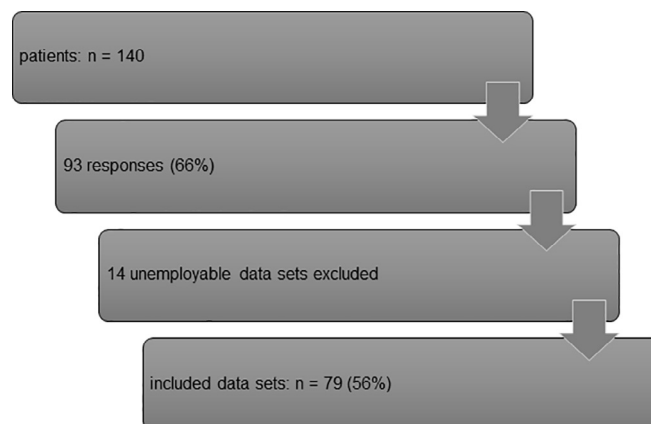


Fig. 1. Flowchart for data acquisition.

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