ODOR DISORDERS AND RARE NEUROLOGICAL COMPLICATIONS IN ENDOSCOPIC SINUS SURGERY. 
CLINICAL STUDIES

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ABSTRACT
Introduction: The evaluating olfactory dysfunction after endoscopic sinus surgery.

Materials and Method: Patients who underwent endoscopic sinus surgery between 2008 and 2020 in the ENT clinic of our hospital were evaluated retrospectively.

Results: Endoscopic sinus surgery was applied to 155 patients between 2008 and 2020 in our clinic. 85 patients aged between 20-68 (mean 44) were included in the study. Patients who underwent endoscopic septoplasty and endoscopic concha bullosa resection and cases with missing file information were excluded from the study. 35 (41%) of the cases were female and 50 (59%) were male. Endoscopic sinus surgery was performed bilaterally in 67 (78.8%) and unilaterally in 18 (21.2%) out of 85 cases. Histopathologically, 52 (61.2%) nasal polyps, 20 (23.8%) chronic sinusitis, 7 (8.6%) antroconal polyps, 3 (3.5%) inverted papilloma, 3 (2.3%) osteoma were found. Hyposmia was detected in five (5.8%) cases and anosmia was found in two (2.3%) cases. Major complications such as cerebrospinal fluid leakage and optic nerve damage were not observed.

Conclusion: Attention should be paid to odor disorders after endoscopic sinus surgery.

KEYWORDS Endoscopic Sinus Surgery, Anosmia, Nasal Polyp, Hyposmia, Cerebrospinal Fluid Leakage

Introduction
Complication rates arising from endoscopic sinus surgery (ESS) are low. The relationship between the paranasal sinuses and surrounding structures may reveal negative results in surgery. Knowledge of the complex anatomical relationships between the paranasal sinuses and the skull base and orbit is necessary to prevent serious complications (Figure-1-a.b) [1]. While most of the patients who underwent ESS recovers with a single operation, the rate of minor complication is 5.4%, the major complication rate is 1.1%, and 10-19 % of them require revision surgery [2]. Cerebrospinal fluid (CSF) leakage, odor disorders, and optic nerve damage are rare neurological complications [3]. These complications can be further reduced with increased surgical experience and new technologies. This article, it was evaluated the rare neurological complications seen in our cases.

Materials and Method
The patients who underwent ESS in our hospital between 2008 and 2020 were evaluated retrospectively. ESS was applied to 155 cases. Eighty-five patients aged between 20 and 68 (mean 44) were included in the study. Those who underwent endoscopic septoplasty and endoscopic concha bullosa resection and cases with missing file information were excluded from the study. 35 (41%) of the cases were female, and 50 (59%) were male. All cases were operated under general anaesthesia. Cotton rape-seed containing lidocaine and adrenaline were placed in the preoperative intranasal cavity and local anaesthesia was administered with 1/100,000 adrenaline and jetocaine. ESS was performed using the Messerklinger technique. After 72 h the postoperatively,"Sniffin sticks" test and the electrical signals created by the smell in the brain were recorded by giving alternating normal and scented air to the patient’s nose in the laboratory.
Histopathological results and neurological complications were obtained from file records.

Approval for our article was received from the Medical and Health Sciences Research Board with the date 07.09.2021 and number KA21/371.

Results

Bilateral endoscopic sinus surgery (ESS) was performed in 67 (78.8%) cases and unilateral in 18 (21.2%) cases. Histopathology distribution 52 (61.2%) nasal polyps, 20 (23.8%) chronic sinusitis, 7 (8.2%) antroconal polyps, 3 (3.5%) inverted papillomas, 3 (3.5%) osteomas. Hyposmia was detected in five (5.8%) cases and anosmia in two (2.3%) cases. CSF leakage and optic nerve damage did not occur in our patients (Table-1).

Discussion

Sinonasal surgery is a leading cause of medicolegal procedures and is an area of surgeon concern. The exact incidence of complications related to endoscopic sinus surgery (ESS) is unknown. In a meta-analysis [4] of 2583 patients who underwent ESS, a major complication rate of 1.1% and a minor complication rate of 5.4% was reported, and surgical experience showed a significant reduction in the complication rate [2]. Complications associated with ESS depend on many factors, including anatomical variations, surgeon inexperience, intraoperative disorientation, poor intraoperative vision, and revision surgery. Animal models and virtual surgery simulators have been developed to improve physician education in ESS [5].

Optic nerve injury is the most problematic neurological complication of ESS, and it can be severe and incurable. Optic nerve injury after ESS is very rare, with recent analyzes presenting rates ranging from 0.07 to 0.23%, which is significantly less than rates reported before the endoscopic period [6]. We did not encounter optic nerve damage in our study. We think that this situation is due to a careful preoperative computed tomography (CT) evaluation, preparation, and surgery. In this group of surgeries, preoperative CT images should be carefully examined for the integrity of the lamina papyracea and the relationship of the uncinate prominence with the medial orbital wall [7]. It should be determined whether it is ethmoidal localized or not. The optic nerve can be found in or near Onodi cells [8].

Cerebrospinal fluid (CSF) leakage is among the more common major complications of ESS. Although the incidence of intracranial complications, including CSF leaks, is reported to be approximately 0.5%, this rate has decreased, especially after technological advances that facilitate improved image guidance [4,9]. Their colleagues found the incidence of occult CSF fistula to be 2.9% through beta transferrin detection [9]. In the largest series in the literature, CSF leak was reported in 103 (0.13%) of 78,944 cases who underwent primary ESS [10]. This figure may be higher in patients with revision sinus surgery or complicated chronic sinus disease. Preoperative evaluation of variable skull base anatomy is key to preventing neurological complications. Any opening in the skull base should be noted in the preoperative imaging evaluation. The skull base classification of Keros is important in the preoperative evaluation (Figure-2). In the presence of type III Keros (lamina lateralis 8-16 mm deep), the risk of CSF leakage is high. Although present in only about 1% of the population, recognition of this anatomical variant is crucial. In cases with this skull base configuration, a sinus surgeon may want to be much more conservative. The preoperative CT evaluation should note any asymmetry in the Keros configuration between the two skull base sides [11].

Olfactory defects may be iatrogenic, especially when the olfactory elements in the cribiform area are impaired during sinus and skull base surgery. About two-thirds of patients with chronic rhinosinusitis (CRS) complain preoperative dysosmia. It is difficult to estimate the extent to which iatrogenic deterioration leads to this complication. A survey of 184 patients who underwent nose surgery noted that 4 patients (2.5%) reported new olfactory deficits after surgery [11]. In our study, hyposmia was found in five (5.8%) cases and anosmia in two (2.3%) cases after ESS.
Table 1  Histopathological distribution of the cases

| Histopathology            | Bilateral | Unilateral | total | Neurological Complication |
|---------------------------|-----------|------------|-------|--------------------------|
|                           |           |            |       | Anosmia | Hyposmia | Rinorrhea |
| Nasal polyp               | 50        | 2          | 52    | 2       | 1        | -         |
| Cronik sinüsitis          | 17        | 3          | 20    | -       | 1        | -         |
| Antrachoanal polyp        | -         | 7          | 7     | -       | 2        | -         |
| İnverted papilloma        | -         | 3          | 3     | -       | 1        | -         |
| Osteoma                   | -         | 3          | 3     | -       | -        | -         |
| Total                     | 67(78.8%) | 18(21.2%)  | 85(100%) | 2(2.3%) | 5 (5.8%) | -         |

of the cases. These complications can be encountered, especially in patients over 60 years of age [13].

Due to the creation of specialized surgical corridors in rhino-neurosurgical surgeries, a well-known set of nasal surgery complications may arise [14]. These are postoperative bleeding, synchondrosis, sinusitis, mucoceles, atrophic rhinitis, bleeding into the orbit, medial rectus muscle injury or pneumocephalus, and tension pneumocephalus. According to the literature, different neurological deficits should be expected postoperatively in 5-40% of cases [13, 14]. There may be oculomotor nerve and abducens nerve injury. Rarely, part of the III. ventricle and optic tract may herniate. Additionally, bilateral blindness, hemi or monoparesis, haemorrhage or infarction of the brain stem (with some fatal outcome), cognitive dysfunctions, and postoperative seizures may occur [13]. After the damage to the hypothalamus, hyperphagia may develop. % of cases, more than 10 have hematomas in the surgical field. Bleeding may be intra or suprasellar localization. Subdural hematomas can be observed at a rate of 5-17% [15]. After endoscopic endonasal skull base interventions, meningitis can be life-threatening in <2% (0%-14%) in the early or late postoperative period [16].

Neurosurgical complications such as rhinorrhea, pneumocephalus, meningitis, subarachnoid haemorrhage, epidural abscess, carotid-cavernous fistula reported in ESS are mostly at the case level [16,17]. Headache and neurological disorders that develop after paranasal sinus surgery should be evaluated in terms of cranial complications. The most important determinants in the management of pneumocephalus after ESS are the patient’s neurological level, the presence of a CSF fistula, and the mass effect of air on computed tomography [18].

Conclusion

It is critical for the surgeon to understand the potential pitfalls encountered during ESS. Detailed knowledge of the complex anatomy surrounding the paranasal sinuses facilitates the avoidance of neurological complications. For preventing surgical complications, the surgeon needs to know the anatomical variants adjacent to the skull base, medial orbital wall and critical structures and to evaluate the preoperative imaging in detail. The complications that may arise are informed before a comprehensive treatment. Information and mutual communication improve the doctor-patient relationship and minimize legal liability in case of a negative outcome.

Funding

This work did not receive any grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest

There are no conflicts of interest to declare by any of the authors of this study.

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