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Rehabilitation of patients with chronic rhinosinusitis after functional endoscopic sinus surgery

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Abstract

Introduction. In the case of many patients with chronic rhinosinusitis (CRS), antibiotic and steroid therapies fail, and surgery is required. The recovery of patients after surgery equally depends on the postoperative behavior of each individual patient. The paper presents the outcomes of recovery after functional endoscopic sinus surgery (FESS) in a group of 74 patients.

Methods. The study was conducted in patients undergoing surgical treatment by FESS, performed by the same surgeon. For the development of the statistical database, the clinical records were collected by the same investigator.

Results. On the day of surgery and on the first postoperative day, 72.9% of patients reported facial pain, 41.8% nausea, 9.4% nasal bleeding, 8.8% vomiting. At 6 months postoperatively, 71.6% of patients estimated that they had a better quality of life than before surgery, 64.8% mentioned an improvement of olfaction as an effect, and 6.7% developed septal turbinate synechiae.

Conclusions. No major complications were identified in the recovery of CRS patients after FESS. Postoperative facial pain was less well tolerated by young patients (18-35 years old). The improvement of smell and the increase of disease-specific quality of life are the most relevant results of recovery after FESS mentioned by the patients included in our study. The otorhinolaryngologist and the family doctor play an important role in the education of patients regarding the importance of treatment with mineral and thermal waters in post-FESS recovery.

Keywords: *chronic rhinosinusitis, endoscopic sinus surgery, FESS, rehabilitation, ERAS protocols,*

1 Introduction

Chronic rhinosinusitis (CRS) represents a wide range of infectious-inflammatory processes affecting the nose and paranasal sinus mucosa simultaneously (1). CRS is an extremely common chronic disease, having a significant impact on the quality of life of patients. The pathophysiological mechanisms in CRS are varied, not mutually exclusive and are closely intricate, having the center in the microbial factor (2).

According to the European Position Paper on Rhinosinusitis and Nasal Polyps (EPOS) 2020, CRS is diagnosed based on the following criteria: two or more symptoms (nasal blockage/ obstruction/ congestion or anterior/ posterior nasal discharge, ± facial pain/pressure, ± reduction or loss of smell) for ≥12 weeks, and endoscopic signs (nasal polyps, and/or mucopurulent discharge from the middle meatus and/or edema/mucosal obstruction in the middle meatus) and/or CT changes (mucosal changes within the ostiomeatal complex and/or sinuses) (3).

The most simplified classification, based on pathogenesis, divides CRS into patients without nasal polyps (CRSsNP) and with nasal polyps (CRSwNP) (4).

In CRS, the changes in the mucosa lead to favorable conditions for the growth and development of a microbial biofilm. Once formed, the biofilm determines the continuous presentation of antigens and maintains the chronic inflammatory process (5). At this stage, antibiotic and steroid therapies fail, and surgery is required.

Functional endoscopic sinus surgery (FESS) is the gold standard for treating CRS but is also used in rhinosinus tumor pathology (6-7). The goals of FESS in the treatment of CRS are enlarging sinus ostia, restoring physiological aeration of sinuses, improving mucociliary transport, and providing a better way for topical therapies

(6). Compared to the transoral approach, FESS is less invasive, allows the preservation of sinus anatomy and a reduction of the recovery time, with symptomatic improvements reported by approximately 90% of patients (8-9). Nevertheless, the surgical outcome not only depends on a successful surgical technique, but also on the postoperative behavior of patients and their compliance with the medical indications after surgery.

The recovery of CRS patients after FESS can be delayed by the occurrence of the following situations: side effects/immediate postoperative complications (pain, hemorrhage, and crusting), short-term complications (infection, synechiae formation, and turbinate lateralization), and long-term complications (ostial stenosis, refractory disease, and disease recurrence) (9).

The aim of this study is to present the results obtained by our team regarding the rehabilitation of CRS patients after FESS, in a group of patients undergoing surgery in the 2nd Otorhinolaryngology Clinic in Cluj-Napoca.

2 Material and method

2.1 Study design and population

We conducted a retrospective observational study on patients with CRS admitted to the 2nd Otorhinolaryngology Clinic of the University Clinical Hospital of Railway Company, Cluj-Napoca, in the period January 2017 - December 2019.

The patients were identified in the hospital database based on their CRS code at discharge. We included in the study patients diagnosed with CRS according to the EPOS 2020 criteria (3), with failure of conservative treatment and undergoing surgical FESS treatment in our clinic. We excluded patients under the age of 18 years, patients with previous rhinosinus surgery, psychiatric disorders, malignant tumors/associated autoimmune diseases, cystic fibrosis, Kartagener syndrome and granulomatous diseases, pregnant women, as well as those with incompletely recorded data.

For the development of the statistical database, the clinical records were collected by the same investigator. From each medical record, the following were extracted: age, sex, diagnoses, operative protocol, postoperative clinical evolution, treatment performed, result of rhinological examination at discharge, recovery evaluations. The patients' privacy and confidentiality were protected while respecting the laws in force: Law 95/2006 on Health Reform, art. 40 and art. 653, L. 95/2006, par. 2-4, the Medical Deontology Code, art. 16-20, as well as Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data and repealing Directive 95/46/CE (General Regulation on data protection, art. 12-20).

The study protocol was approved by the University Clinical Hospital of Railway Company Ethics Council under No. 10/09.12.2020.

2.2 Perioperative procedures

Preoperatively, the patients were informed and counseled regarding the surgery and its potential complications, antianxiety drugs were administered for improving sleeping quality on patients' request, and patients fasted for solids and fluids for 8 hours prior to surgery.

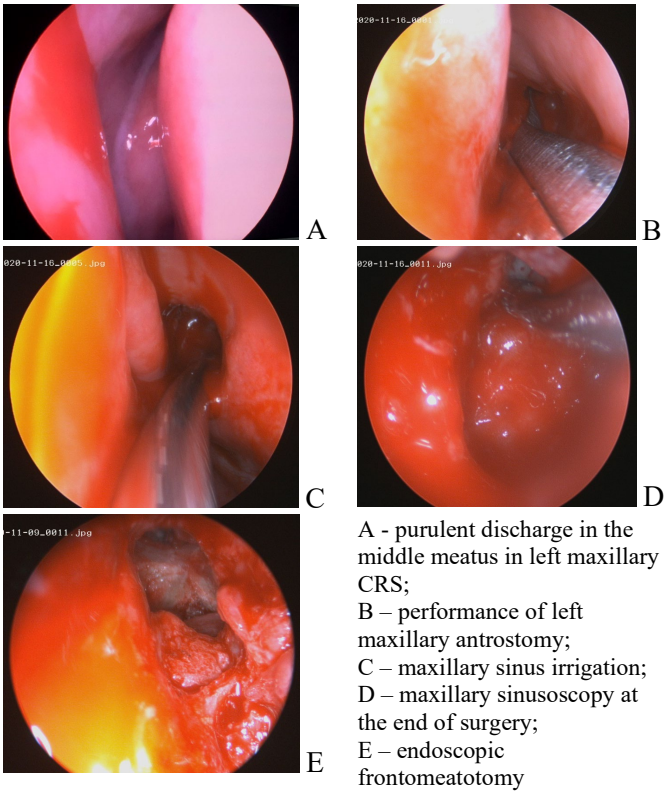
After the allergy test, a preventive antibiotic (1 g ceftriaxone i.v.) was administered 30 minutes before surgery. After induction of general anesthesia through orotracheal intubation, the nasal vestibule was cleaned with iodine, the nasal cavity with saline solution, and a local vasoconstrictor agent was instilled prior to surgery. For all patients included in the study, FESS surgery (Fig. 1) was performed by the same surgeon (main surgeon). At the end of the surgery, metoclopramide was administered i.v. and anterior nasal packing with gauze or expandable Merocel nasal tampon was performed.

Postoperatively, patients benefited from bed rest, with guided mobilization on their request, electrocardiograph and blood pressure monitoring if needed, 8-hour fasting for solids and fluids. During the first 3 postoperative days, the treatment scheme included: ceftriaxone 2 g/day i.v. divided q12h, metamizole 2 g/day i.m. divided q12h (or in NaCl infusion 0.9%) (replaced by acetaminophen or a nonsteroidal anti-inflammatory drug (NSAID) in the case of patients allergic to metamizole), hemostatic cocktail (phytomenadione 20 mg/day, carbazochrome 3 mg/day, and etamsylate 500 mg/day, all divided q12h) in i.v. infusion of 500 ml NaCl 0.9%, and treatment of associated chronic diseases. The nasal packing was removed at 24 hours postoperatively, and for patients with moderate/severe intraoperative hemorrhage at 48 hours postoperatively.

The patients were discharged on the second postoperative day, except for elderly patients, with multiple comorbidities, who were discharged on the fourth postoperative day. At discharge, patients received the recommendation to use hypertonic seawater for nasal irrigation for 14 days, and then topical vitamin A oils for another 14 days.

2.3 Recovery evaluation

Recovery evaluation was performed by the main surgeon at one month and 6 months after FESS. The patients were asked about their quality of life, facial pain, nasal bleeding and improvement of smell. Nasal endoscopy was performed for evaluation of nasal blockage, appearance of the mucosa, signs of infection, presence of crusting or synechia.



A - purulent discharge in the middle meatus in left maxillary CRS;
B – performance of left maxillary antrostomy;
C – maxillary sinus irrigation;
D – maxillary sinusoscopy at the end of surgery;
E – endoscopic frontomeatotomy

Fig. 1. Functional endoscopic sinus surgery – intraoperative aspects:

3 Results

The study inclusion criteria were met by 74 CRS patients, who gave their informed consent for participation in the study. Of all participants, 35 were male and 39 were female, aged between 18 and 84 years at the time of surgery. Odontogenic CRS was most common (39.2%, n = 29/74), followed by CRSwNP (35.1%, n = 26/74), CRSsNP (19%, n = 14/74) and sphenoid CRS (6.7%, n=5/74). The distribution of the CRS patient group depending on age, sex and diagnosis is shown in Table I.

Table I. Distribution of the CRS patient group

GENDER DISTRIBUTION					
Gender		Male	Female		
No. of patients		35	39		74
AGE DISTRIBUTION					
Age	**No**	**CRSsNP** (Primary CRS diffuse non-type 2)	**CRSwNP** (Primary CRS diffuse type 2)	**Odonto-genic CRS** (Secondary CRS unilateral)	**Sphenoid CRS**
18-29	11	2	4	5	-
30-49	32	7	14	11	-
50-69	21	3	6	9	3
>70	10	2	2	4	2

Essential hypertension was found in 32.4% (n = 24/74) of patients, and 14.8% (n = 11/74) of patients had type 2 diabetes mellitus.

3.1 Postoperative facial pain

This was the most frequent symptom reported by patients on the day of surgery and on the first postoperative day - 72.9% (n = 54/74). Also, on the day of surgery and on the first postoperative day, an additional dose of analgesic was requested by 47.2% (n = 35/74) of the patients and two additional doses by 18.9% (n = 14/74, of which 57.1%, n = 8/14 were young patients aged between 18-35 years) - Table II.

3.2 Postoperative nasal bleeding

On the day of surgery and on the first postoperative day, 9.4% (n = 7/74) of patients complained of nasal bleeding that did not stop spontaneously, with a duration longer than 5 minutes. Each patient was administered an additional dose of hemostatic agent. Another nasal packing was required for 2.7% of all patients (n = 2/74, both of which had blood pressure increases over 160/90 mmHg at the time of hemorrhage; an angiotensin converting enzyme inhibitor tablet was administered sublingually, followed by a decrease in blood pressure values).

3.3 Postoperative nausea and vomiting

Nausea was the second most frequent symptom reported on the day of surgery and on the first postoperative day - 41.8% (n = 31/74), while vomiting represented 8.8% (n = 12/74). Patients who complained of intense nausea and imminent emesis received metoclopramide 10 mg i.v. in slow infusion or i.m.

Other postoperative complications were dizziness (25.6%, n = 19/74) and hypotension (<100/70 mmHg, 10.8%, n = 8/74).

3.4 Recovery evaluation

At one month postoperatively, 41.8% of patients (n = 31/74) estimated that they had an improved quality of life and were satisfied with the results of surgery; after 6 months, their proportion increased to 71.6% (n = 53/74).

At one month postoperatively, 10.8% of patients (n = 8/74) reported facial pain, and after six months, their percentage decreased to 4% (n = 3/74).

Nasal bleeding was reported by 2.7% of patients (n = 2/74) after one month postoperatively, and after six months, by no patient.

An improvement of smell (subjective) was reported by 31% of patients (n = 23/74) at one month postoperatively, and after six months, their proportion increased to 64.8% (n = 48/74).

At one month postoperatively, we identified the presence of crusting in 64.8% of patients (n = 48/74), and after six months, only in 2.7% (n = 2/74). At six months postoperatively, 6.7% (n = 7/74) of patients developed septal turbinate synechiae, and 2.7% (n = 2/74) had refractory CRS (Table II).

4 Discussions

The recovery of CRS patients after FESS is influenced by perioperative procedures, the occurrence of postoperative complications, patient's perioperative stress, and particular individual factors (10-11).

Table II. Recovery variables in CRS patients

	Day of surgery and first postoperative day	One month postoperatively	Six months postoperatively
Facial pain	72.9% (n = 54/74)	10.8% (n = 8/74)	4% (n = 3/74)
Nasal bleeding	9.4% (n = 3/74)	2.7% (n = 2/74)	-
Nausea	41.8% (n = 31/74)	-	-
Vomiting	8.8% (n = 12/74)	-	-
Improvement of smell (subjective)	-	31% (n = 23/74)	64.8% (n = 48/74)
Crusting	-	64.8% (n = 48/74)	2.7% (n = 2/74)
Septal turbinate synechia	-	-	2.7% (n = 2/74)

4.1 Enhanced recovery after surgery (ERAS) protocols

ERAS indicate a series of perioperative treatments aimed at accelerating recovery by reducing physical and mental stress associated with surgery, without increasing postoperative complications (12). Using ERAS protocols can improve the experience of hospitalization and quality of life, while the duration and expenses of hospitalization can be reduced. ERAS protocols are structured in three phases of care and contain both identical stages and stages that are newly introduced or applied differently than traditional protocols. ERAS protocols have been recently introduced in otorhinolaryngology as well, but there are few reports of ERAS in patients undergoing FESS (10,13). We present an ERAS protocol synthesis in patients undergoing FESS.

Preoperative care includes preoperative counseling for each patient, antianxiety drugs administered for improving sleeping quality as needed, a NSAID administered the night before surgery to induce preventive analgesia, and fasting 8 hours before surgery for solids and 2 hours for fluids, with administration of a carbohydrate drink 2 hours prior to surgery (10).

Intraoperative care. A preventive antibiotic is administered 30 minutes before surgery, short-acting sedatives and short-acting opioid analgesics are administered during surgery, topical tetracaine and local lidocaine infiltration before surgery, crystalloid solutions are reduced when moderate colloid fluid is given, degradable hemostatic material for nasal packing is used (10).

Postoperative care includes bed rest, electrocardiograph monitoring, oxygen inhalation therapy for 2 hours, pain management, the possibility of feeding soft foods 2 hours after surgery according to gastrointestinal tract tolerance, out-of-bed activities guided according to individual recovery conditions. Long-term fasting, postoperative pain and lesions associated with FESS can aggravate the stress reaction, with the impairment of postoperative recovery (10).

4.2 Postoperative pain management

Postoperative pain control is an important objective with an impact on patient's life and recovery. In a prospective study, 101 FESS patients were examined on the first postoperative day, after removal of the nasal packing, within a project of standardized evaluation of pain parameters. Statistical analysis showed that pain during the first postoperative day after FESS was moderate, young patients reporting higher scores than elderly patients (14). In our study, 57% (n = 8/14) of the patients who requested additional doses of analgesics on the day of surgery and on the first postoperative day were young persons aged between 18-35 years.

A survey conducted in 2018 among 168 members of the American Rhinologic Society representing all regions of the United States showed that the most commonly prescribed medications for pain after FESS were *opioid* pills (15). Another study regarding the responsible prescription of postoperative pain medications in the current context of opioid epidemic in the United States shows that the majority of patients undergoing FESS take approximately 5 opioid tablets after surgery, but concurrent septoplasty, younger age and a history of antidepressant use were associated with increased opioid usage (16-17). Some authors consider that the majority of patients would not need any opioid medication for postoperative pain control (18). There is evidence supporting the use of *NSAIDs*, *gabapentin*, *acetaminophen*, *α-agonists*, and *local anesthetics* can be viable options for the control of pain after FESS (19).

Unlike traditional postoperative analgesia protocols, according to which analgesics are administered when needed, ERAS protocols recommend preventive NSAID analgesia due to its efficacy and the low rate of adverse reactions. A NSAID (intravenous injection) for preventive analgesia can be administered at 2 hours and 12 hours postoperatively (10).

4.3 Postoperative nasal bleeding

It is a frequent complication after FESS. This is why at the end of surgery, anterior nasal packing with different, usually non-absorbable, materials is performed. Absorbable nasal packing was introduced more recently. Although there is some evidence in the literature that absorbable nasal packing would provide better results compared to nonabsorbable packing after FESS regarding postoperative nasal bleeding and synechiae, the lack of homogeneity between studies makes it difficult to draw definitive conclusions (20).

4.4 Postoperative nausea and vomiting

Postoperative nausea and vomiting are among the most common adverse events following surgery under general anesthesia. The bilateral endoscopic injection of *lidocaine with epinephrine* in the sphenopalatine ganglion at the end of FESS is safe, non-invasive, and can reduce early postoperative nausea and vomiting (21). The placement of *pharyngeal packs* during FESS does not significantly improve postoperative nausea and vomiting and increases the risk of complications (including aspiration and death) (22).

4.5 Olfaction recovery

Olfactory dysfunction, a common symptom in CRS patients, is caused by obstruction from polyps, nasal discharge, mucosal edema, and inflammation of the olfactory epithelium (23).

FESS improves the recovery of olfaction in CRS patients, especially if the patient had CRS with polyps, anosmia, and had no prior surgery. A deterioration of smell after FESS is rare (24-25). Preoperative systemic corticosteroid therapy ensures a better predictive rate of olfactory recovery after FESS, especially for CRS with polyps (26). Also, crenotherapy can improve olfactory function (27).

4.6 Topical agents for nasal mucosa recovery

A number of topical agents for cleansing the nasal cavity and regenerating the sinonasal mucosa postoperatively have been studied.

Cleansing the nasal cavity by nasal irrigation plays an important role in postoperative care: it facilitates maintaining the permeability of the nasal fossae, reduces the amount of nasal secretions, inhibits crusting and accelerates the healing of nasal mucosal lesions. Unlike isotonic saline solution, *seawater* contains fewer sodium ions, but is rich in bicarbonates, potassium, calcium and magnesium. Bicarbonates reduce secretion viscosity, potassium and magnesium promote healing through limiting local inflammation, alkaline pH and elevated calcium concentration optimize ciliary motility. Large-volume low-pressure nasal irrigation using undiluted seawater seems the most effective alternative for postoperative cleansing of the nasal cavity (28).

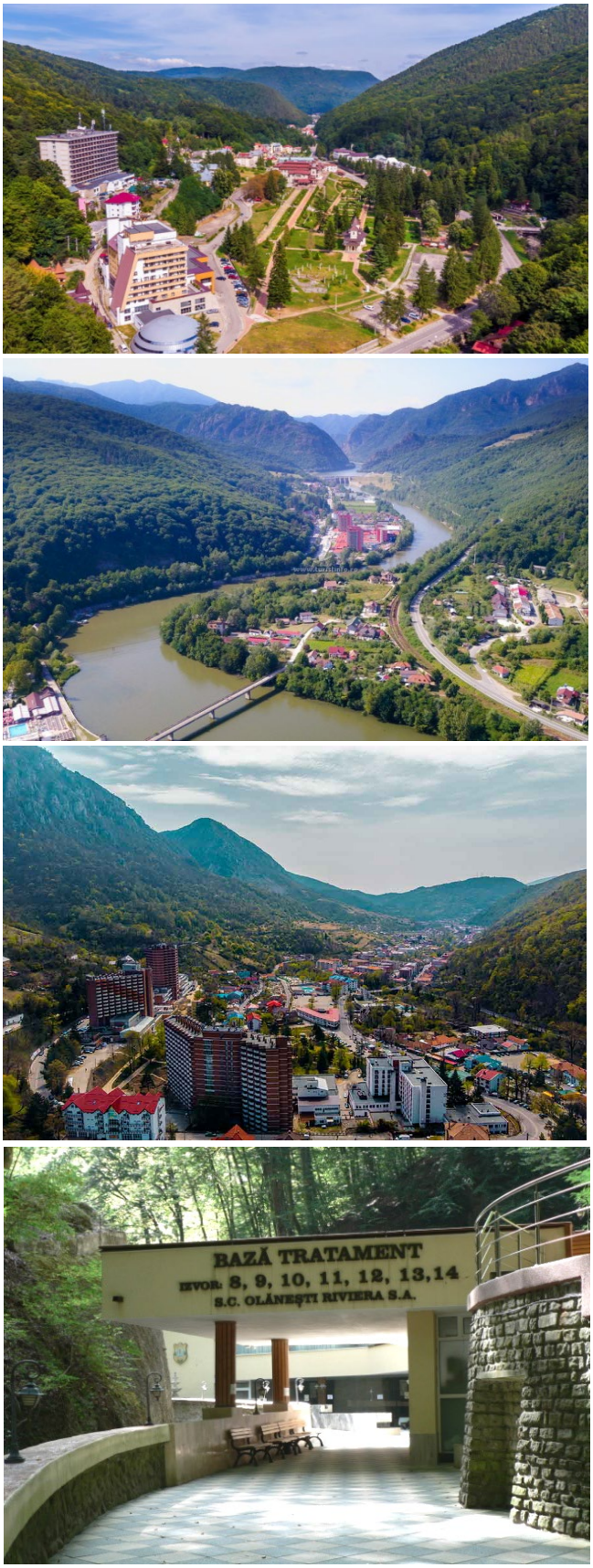
Regarding the use of hypertonic saline solutions/hypertonic seawater, there is no consensus in the literature. Some authors maintain that hypertonic saline can be associated with a greater benefit on endoscopic scores and mucociliary clearance than isotonic solutions and recommend it in postoperative care, especially for CRSwNP patients (29-30). A study shows that buffered hypertonic seawater has a better inhibitory effect on mucosal edema and crusting during the early postoperative care period of CRSwNP patients (31). Other authors argue that hypertonic saline solutions/hypertonic seawater can damage sinonasal epithelial cells in air-liquid interface cultures, inducing significant disruption of the epithelial mucociliary and barrier function, while isotonic saline/isotonic seawater does not affect epithelial mucociliary and barrier function (32). A meta-analysis on nasal irrigation with hypertonic saline solutions versus isotonic saline shows that hypertonic saline improves symptoms over isotonic saline in treating sinonasal diseases, but hypertonic saline causes more minor side effects than isotonic saline (33).

Hyaluronic acid and *steroids* are considered efficient factors in recovery management after FESS in CRS patients (34-36). Steroid-impregnated nasal packing and topical corticosteroid sinus irrigations have positive postsurgical effects on the recovery of CRS patients, especially those with polyps, undergoing FESS (37-38).

Oily vitamin A and E solutions stimulate nasal mucosal regeneration, prevent crusting and contribute to the restoration of epithelial barrier function (39). Topical treatment with α-tocopherol acetate in elderly patients affected by CRS after FESS improves and speeds up the process of restoring the sinonasal mucosa (40). Vitamin A, alone or in combinations, prevents the formation of stenosis and is favorable for wound healing (41).

After healing of open mucosal lesions, *sun and sea therapy* can be an adjuvant in recovery. In addition to the chemical properties of seawater, marine flora can have an immunomodulatory therapeutic effect on sinusitis (42).

Topical anti-infective solutions can be considered as a potential option for refractory CRS patients with failed FESS (43). CRS patients showing recurrence after FESS despite postoperative irrigations with topical corticosteroids may respond to the addition of azithromycin as part of therapy (44).



A B C D

Fig. 2. Romanian spa resorts with mineral and thermal waters useful for the recovery of CRS patients after FESS [55]: A - Slănic Moldova; B - Călimănești-Căciulata; C - Herculane; D – Olănești

Mineral and thermal waters are recognized in balneology for their efficacy in postoperative recovery. Treatments with sulphurous, arsenical-ferruginous or chloride-sodium water may complete the rehabilitation program after FESS, leading to an improvement in nasal flow and a decrease in nasal resistance, a reduction of the mucociliary transport time and pathological microbial flora (45-46). Mineral tratments are administered by various respiratory therapy equipments (aerosols, inhalation, baric chamber) or by nasal irrigations (47).
In Romania, mineral and thermal waters in the resorts Govora, Slănic Moldova, Herculane, Călimănești-Căciulata and Olănești (Fig. 2) can be used during the recovery period of CRS patients (48). All patients included in our study received the recommendation of treatment with mineral and thermal waters during post-FESS recovery, but none of them followed this recommendation in the evaluation period for this study.

4.7 Middle turbinate lateralization and synechia

The lateralization of the middle turbinate after FESS can obstruct the ethmoid and maxillary sinuses. Middle turbinate-septal suture medialization can be an effective method for preventing the lateralization of the middle turbinate and does not impair olfactory function (49-50).
The prevalence of synechia seems to be lower (4.6-8%) when absorbable nasal packing is used compared to nonabsorbable packing (8-35.7%) (51). On the examination performed 6 months after FESS, synechiae were observed in 6.7% of the patients, using nonabsorbable packing for all patients.

4.8 Recovery of elderly patients

Advanced age has been associated with functional changes in the sinonasal tract and alterations of local innate immune defense mechanisms (52). Furthermore, immunosenescence may have a negative impact on chronic inflammatory diseases (53). Thus, advanced age influences CRS pathophysiology and the response to medical and surgical therapy.
Elderly patients with CRS have higher rates of complications following FESS, and can present adverse effects related to steroid use, given the comorbidities associated with age. Data suggest that approximately one-third of patients over 60 years of age fail to achieve a clinically meaningful difference in disease-specific quality of life after FESS (54). We identified no significant difference between age groups regarding disease-specific quality of life after FESS.

5 Conclusions

The patients included in our study reported no major complications in the first 6 months of the post-FESS recovery period.

Postoperative facial pain was less well tolerated by young patients (18-35 years old), in the case of which postoperative pain management may require higher doses of analgesics.

Improving olfaction and disease-specific quality of life is the main objective of recovery.

Because patients neglect treatment with mineral and thermal waters in post-FESS recovery, the otorhinolaryngologist and the family doctor play an important role in educating patients to understand the therapeutic benefits of this option.

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