ORIGINAL PAPERS

Adv Clin Exp Med 2014, **23**, 1, 69–78
ISSN 1899–5276

Tomasz Grzegorzek[1, A–D, F], Bogdan Kolebacz[1, B, E, F],
Grażyna Stryjewska-Makuch[1, B, E, F], Alicja Kasperska-Zając[2, C, E, F],
Maciej Misiołek[3, A, C, E, F]

The Influence of Selected Preoperative Factors on the Course of Endoscopic Surgery in Patients with Chronic Rhinosinusitis

[1] Department of Laryngology, Independent Public Clinical Hospital No. 7, Medical University of Silesia in Katowice, Poland
[2] Department of Internal Diseases, Allergology and Immunology, Medical University of Silesia in Katowice, Poland
[3] Clinical Department of Laryngology in Zabrze, Medical University of Silesia in Katowice, Poland

A – research concept and design; **B** – collection and/or assembly of data; **C** – data analysis and interpretation; **D** – writing the article; **E** – critical revision of the article; **F** – final approval of article; **G** – other

Abstract

Background. Epidemiological data shows the increasing prevalence of chronic rhinosinusitis which poses significant health, social and economic problems in today's world. Endoscopic paranasal sinus surgery is currently the method of choice in the treatment of chronic rhinosinusitis when conservative treatment methods fail. Therefore, maintaining a high percentage of therapeutic success with a constantly growing number of surgical procedures poses the major challenge to otolaryngologists. Appropriate surgical conditions have a great influence on the course of surgical procedure, the risk of complications and postoperative outcomes.
Objectives. The aim of this study was to analyse the influence of selected perioperative factors on the course of endoscopic surgery in patients with chronic rhinosinusitis.
Material and Methods. A group of 212 patients (105 women and 107 men) aged 19 to 74 (mean age 46.5) diagnosed with chronic rhinosinusitis were enrolled in the retrospective study. All patients underwent endoscopic sinus surgery. The analysis was concerned with the impact of such factors and clinical parameters as gender and age of patients, disease progression, previous (conservative and surgical) treatment, comorbidities, detrimental external factors, the scope of surgical treatment influencing the duration of surgery, bleeding in the surgical field and the total blood loss during surgery.
Conclusions. It was found that the mean duration of surgery in the study group was 40.2 min, the mean blood loss was 312.17 mL and the mean degree of intraoperative bleeding scale reached 2.15. The intraoperative conditions deteriorate together with the increasing age of patients. Selected factors and clinical parameters, such as impaired nasal patency, olfactory disorders, the occurrence of nasal polyps, prior surgical treatment, the presence of aspirin-induced asthma and cardiovascular diseases, intranasal glucocorticoid therapy, a high degree of inflammatory changes in the sinuses and a large extent of surgery substantially influence the deterioration in intraoperative conditions. Knowledge of these factors and their impact on surgery enables more thorough, multidisciplinary preparation of patients for surgery, and thus enables the optimisation of surgical conditions (**Adv Clin Exp Med 2014, 23, 1, 69–78**).

Key words: chronic rhinosinusitis, endoscopic sinus surgery, FESS, nasal polyps.

Rhinosinusitis is one of the more common reasons for medical appointments with laryngologists. It is a disease with diverse symptomatology, and rhinosinusitis-related symptoms affect negatively the quality of life and can significantly impair daily functioning.

Epidemiological data shows that the number of rhinosinusitis-related appointments in the United States exceeds 30 m annually and this number is higher compared to medical appointments due to arterial hypertension or arthritis [1]. Each year about 2.6 m cases of chronic rhinosinusitis are

noted in Germany [2]. This data shows that chronic rhinosinusitis poses significant health, social and economic problems in today's world. Thus, more and more attention is paid to developing the most effective treatment method.

The treatment regimen in patients with symptoms of chronic rhinosinusitis recommended by EPOS 2012 (European Position Paper on Rhinosinusitis and Nasal Polyps of 2012) is based on the administration of glucocorticoids and the rinsing of the nasal cavity with saline solution. A lack of treatment results in patients with mild symptoms after 3-month therapy is an indication for computed tomography (CT) of paranasal sinuses and should lead to a decision to treat patients surgically, which will also enable effective pharmacotherapy at a later stage. The inclusion of long-term treatment with intranasal glucocorticoids after surgical procedure provides a better therapeutic effect and an extension of the period between successive operations. In many treatment regimens long-term macrolide therapy [3, 4] is also used and in some cases tetracyclines are administered [4]. Studies conducted at the cellular level have shown antiproliferative and anti-inflammatory effects of vitamin D analogs in the cells of nasal polyps in patients with chronic rhinosinusitis [5].

Surgical procedure plays an important role in the treatment regimen of chronic rhinosinusitis. It is currently based on the concept of functional endoscopic surgery. The aim of functional endoscopic sinus surgery (FESS) is to restore the patency of natural sinus ostia, which provides proper ventilation of the inside of the sinus and improves its drainage, leading to the healing of the inflamed mucous membrane [6, 7].

The proper course and the expected therapeutic effect of endoscopic paranasal sinus surgery requires a number of conditions to be followed. These include the stage of preparing patients for surgery, the proper qualification for surgery, the proper performance of surgery and the right provision of post-operative care. The precise control of the above stages of treatment will improve the operating conditions and reduce the likelihood of perioperative complications and thus improve the effectiveness of treatment [8, 9].

Based on one's own clinical experience and the contemporary medical literature on this matter, an attempt was made to assess individual preoperative factors and their impact on the course of surgery.

Material and Methods

A group of 212 patients (105 women and 107 men) aged 19 to 74 (mean age 46.5) diagnosed with chronic rhinosinusitis were enrolled in the retrospective study. All patients underwent endoscopic paranasal sinus surgery according to the concept of Messerklinger and Stammberger, i.e. functional endoscopic sinus surgery (FESS). Surgical procedures were performed from July 2010 to April 2011.

During the analysis of medical records of the patients, the following preoperative factors and clinical parameters were taken into account:

– age and gender of patients,

– symptoms and signs and the presence of pathological changes in CT of the paranasal sinuses (Table 1) important in the diagnosis of chronic rhinosinusitis (according to the recommendations of EPOS 2012),

– a history of previous surgical procedures due to the inflammation of the nose and paranasal sinuses (nasal polyp removal, Caldwell-Luc procedure, endoscopic sinus surgical procedures),

– the use of intranasal or systemic glucocorticoids due to chronic rhinosinusitis,

– comorbidities (aspirin-induced asthma, cardiovascular diseases, diabetes),

Table 1. Modified classification of severity of chronic rhinosinusitis based on CT of sinuses according to Kennedy

Stage	CT of paranasal sinuses	Patients	
		n = 212	%
1	Anatomical differences in the lateral wall of the nasal cavity All unilateral inflammatory changes Bilateral inflammatory changes in the ethmoid structure	62	29.3
2	Bilateral inflammatory changes in the ethmoid and in one dependent sinus	50	23.6
3	Bilateral inflammatory changes in the ethmoid and in two or more dependent sinuses	59	27.8
4	Extensive nasal polyps and paranasal sinus polyps	41	19.8

– detrimental external factors (smoking, work in dusty areas, constant stay in air-conditioned rooms).

Subsequently, the study of medical documentation concerned the following intraoperative parameters: duration of surgery (in min), blood loss during surgery (in mls), the degree of bleeding in the surgical field evaluated by the surgeon. The above parameters were collected and underwent statistical analysis.

Statistical Analysis

Data was collected and analyzed in a spreadsheet. The verified data was then transferred to a statistical program where the appropriate analysis was performed.

Distribution of quantitative variables was verified by the Shapiro-Wilk test. Depending on the distribution, the Student's *t*-test and the Mann-Whitney *U* test for comparing two subgroups were used interchangeably with analysis of variance (ANOVA) and the Kruskal-Wallis analysis of variance of ranks for more subgroups.

Depending on the distribution, the correlation of quantitative variables was analysed using Spearman's rank correlation.

The results were shown in the tables containing the average value of the examined parameter and its standard deviation for qualitative parameters or quantities with the percentages for qualitative parameters.

For the purposes of the whole analysis, a p-value < 0.05 was considered significant. STATISTICA programme (data analysis software system) version 10.0 from StatSoft, Inc. was used for the calculations.

Results

Age of the Patients

The analyzed group consisted of patients aged between 19 and 74. The mean age was 46.5 years (SD 12.9). The study showed a significant deterioration in intraoperative conditions with an increase in the age of patients undergoing surgery (Fig. 1).

Gender of the Patients

The gender ratio was almost equal in the study group with 107 (50.5%) male patients and 105 (49.5%) female patients. No influence of the gender on intraoperative conditions was demonstrated (Tables 2–4).

Patient-reported Symptoms

After the analysis of the symptoms reported by patients while collecting the medical history, it was found that patients often complain of mucopurulent nasal discharge and impaired nasal patency. The study of the relationship between the operating conditions and symptoms showed that impaired nasal patency, impaired sense of smell and the number of patient-related symptoms had a statistically significant effect on the assessment

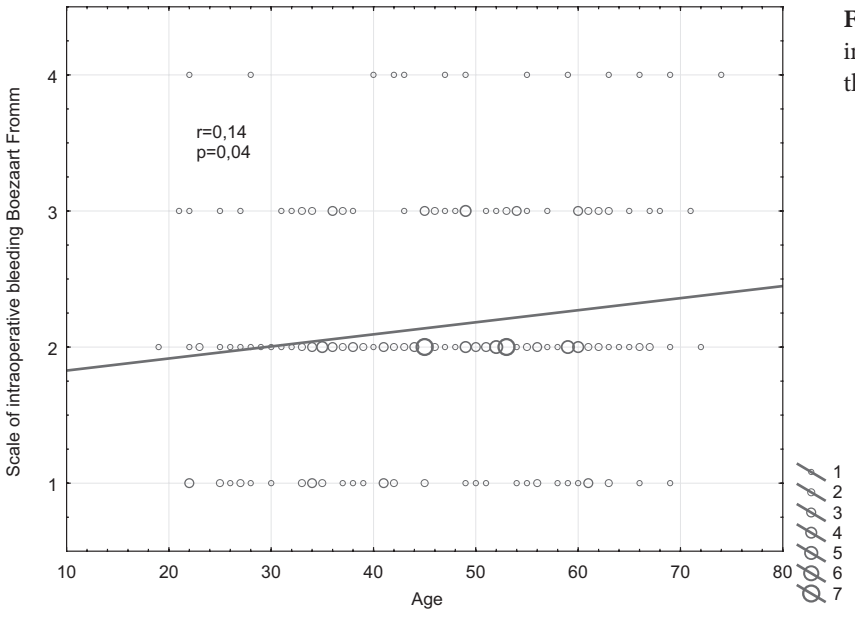

Fig. 1. The relationship between the intraoperative bleeding scale and the age of patients

Table 2. The influence of preoperative factors on the time of surgical procedure

		Time of surgical procedure [min]						
		n♀	mean	SD	n♂	mean	SD	p
Gender		105	39.1	12.9	107	41.2	14.1	0.2669
		Time of surgical procedure [min]						
		Patients with preoperative factors			Patients without preoperative factors			p
		n	mean	SD	n	mean	SD	
Symptoms	headache	120	39.5	13.2	92	41.1	14.0	0.3996
	impaired nasal patency	150	42.2	13.7	62	35.3	12.0	0.0007
	nasal secretion	166	40.5	13.5	46	38.9	13.7	0.4722
	olfactory disorders	59	47.6	13.4	153	37.3	12.5	0.0000
	no of symptoms > 2	76	45.8	13.3	136	37.1	12.7	0.0000
Signs	nasal polyps	66	46.7	13.2	146	37.3	12.7	0.0000
	nasal secretion	144	40.3	13.8	68	39.9	13.1	0.8050
	nasal oedema	182	40.7	13.9	30	37.3	11.4	0.2140
	no of symptoms > 3	139	41.4	13.6	73	37.9	13.2	0.0808
Comorbidities	aspirin-induced asthma	57	43.7	13.0	155	38.9	13.6	0.0225
	cardiovascular diseases	76	43.6	12.8	136	38.3	13.6	0.0066
	diabetes	18	41.1	14.1	194	40.1	13.5	0.7637
Glucocorticoids	intranasal	98	41.8	13.4	114	38.8	13.6	0.1010
	systemic	22	43.2	13.2	190	39.8	13.6	0.2751
Detrimental external factors		70	40.3	15.4	142	40.1	12.6	0.9419
Past surgical procedures		59	46.6	14.2	153	37.7	12.5	0.0000

of intraoperative parameters. For other symptoms, such as the presence of mucopurulent nasal secretion and headache, no statistically significant effect on the operating conditions was demonstrated (Tables 2–4).

Laryngological Examination

Oedema of the nasal mucosa and the presence of mucopurulent nasal secretion were the most frequently observed clinical symptoms reported during the laryngological examination. The presence of nasal polyps and a large number of symptoms had a statistically significant relationship with the deterioration in operating conditions. Such a relationship was not found in the case of the presence of mucopurulent nasal secretion and oedema of the nasal mucosa (Tables 2–4).

Comorbidities

The most common comorbidities included cardiovascular diseases, diabetes and aspirin-induced asthma. The analysis showed that both aspirin-induced asthma and cardiovascular diseases have a significant impact on the deterioration in intraoperative conditions. In diabetes, such a relationship was not observed (Tables 2–4).

Previous surgical procedures due to nasal inflammation and rhinosinusitis.

The data obtained from the medical history in the study group showed that 59 patients (27.83%) had undergone surgical treatment before due to nasal and sinus inflammation (e.g. nasal polyp removal, Caldwell-Luc maxillary sinus surgery, FESS). After the statistical analysis, it was found that the duration of surgery in these patients was extended significantly and the increase in intraoperative bleeding scale and blood loss was reported (Tables 2–4).

Table 3. The influence of preoperative factors on the intraoperative bleeding scale by Boezaart Fromm

		Scale of intraoperative bleeding						
		n♀	mean	SD	n♂	mean	SD	p
Gender		105	2.18	0.79	107	2.12	0.84	0.5979
		Scale of intraoperative bleeding						
		Patients with preoperative factors			Patients without preoperative factors			p
		n	mean	SD	n	mean	SD	
Symptoms	Headache	120	2.10	0.82	92	2.22	0.81	0.3015
	Impaired nasal patency	150	2.23	0.81	62	1.95	0.82	0.0222
	Nasal secretion	166	2.19	0.84	46	2.02	0.75	0.2269
	Olfactory disorders	59	2.58	0.83	153	1.99	0.75	0.0000
	No of symptoms > 2	76	2.39	0.87	136	2.01	0.76	0.0011
Signs	Nasal polyps	66	2.65	0.73	146	1.92	0.75	0.0000
	Nasal secretion	144	2.22	0.85	68	2.01	0.74	0.0957
	Nasal oedema	182	2.15	0.82	30	2.13	0.82	0.8991
	No of symptoms > 3	139	2.28	0.83	73	1.90	0.73	0.0013
Comorbidities	Aspirin-induced asthma	57	2.53	0.76	155	2.01	0.80	0.0000
	Cardiovascular diseases	76	2.43	0.85	136	1.99	0.76	0.0001
	Diabetes	18	1.94	0.64	194	2.17	0.83	0.2638
Glucocorticoids	intranasal	98	2.38	0.82	114	1.96	0.77	0.0002
	systemic	22	2.41	0.80	190	2.12	0.82	0.1181
Detrimental external factors		70	2.03	0.87	142	2.21	0.79	0.1265
Past surgical procedures		59	2.71	0.77	153	1.93	0.73	0.0000

Glucocorticoid Therapy

Glucocorticoids had been commonly used in patients before surgery. More than 50% the study group had undergone general or intranasal glucocorticoid therapy (107 patients, 50.5%). In patients treated with general glucocorticoids, no significant differences in the analysed parameters were found compared to those who had not used the agents prior to surgery. In the group of patients treated with intranasal glucocorticoids both a significantly higher value of the intraoperative bleeding scale and blood loss during surgery were found compared to patients who had not taken glucocorticoids. However, the difference in the duration of surgical procedure was not statistically significant (Tables 2–4).

An additional analysis was performed with relation to the observed close relationship between the use of glucocorticoids prior to surgery and the degree of progression of pathological changes in CT. Intraoperative conditions in patients preoperatively treated with systemic and intranasal glucocorticoids were compared with intraoperative conditions in patients who had not taken the agents. Another analysis was performed for each stage in regards to the progression of inflammatory changes in CT of the paranasal sinuses, according to the Kennedy Scale. This additional comparison revealed that in the study group there was yet again no relationship between systemic glucocorticoid therapy and intraoperative conditions. However, in the group of patients who used intranasal glucocorticoids, relationships changed significantly. For the same stages regarding the progression of inflammatory sinus changes, no differences in intraoperative conditions were observed in both groups of patients.

Table 4. The influence of preoperative factors on blood loss during surgery

		Intraoperative blood loss [mL]						
		n♀	mean			mean		p
Gender		105	322.0			302.5		0.5245
		Intraoperative blood loss [mL]						
		Patients with preoperative factors			Patients without preoperative factors			p
		n	mean	SD	n	mean	SD	
Symptoms	Headache	120	303.9	211.9	92	322.9	235.5	0.5379
	Impaired nasal patency	150	335.7	223.1	62	255.2	210.6	0.0159
	Nasal secretion	166	320.3	230.8	46	282.8	186.7	0.3124
	Olfactory disorders	59	448.5	259.5	153	259.6	181.1	0.0000
	No of symptoms > 2	76	402.8	244.9	136	261.5	191.3	0.0000
Signs	Nasal polyps	66	465.2	234.7	146	243.0	177.9	0.0000
	Nasal secretion	144	326.9	227.8	68	281.0	207.8	0.1612
	Nasal oedema	182	314.9	221.0	30	295.7	231.9	0.6616
	No of symptoms > 3	139	346.5	221.0	73	246.8	210.7	0.0018
Comorbidities	Aspirin-induced asthma	57	431.6	220.5	155	268.3	206.6	0.0000
	Cardiovascular diseases	76	397.8	270.6	136	264.3	173.2	0.0000
	Diabetes	18	302.8	188.2	194	313.0	225.4	0.8518
Glucocorticoids	intranasal	98	382.6	252.0	114	251.7	172.1	0.0000
	systemic	22	380.0	199.5	190	304.3	223.7	0.1306
Detrimental external factors		70	277.9	195.6	142	329.1	232.9	0.1145
Past surgical procedures		59	463.6	243.5	153	253.8	183.1	0.0000

Detrimental External Factors (Smoking, Air-conditioning, Dustiness)

Based on medical history, it was shown that 70 (33%) patients from the study group had regular contact with harmful external conditions at work or the place of residence. The study of the relationship between this exposure and intraoperative conditions did not demonstrate any statistically significant correlation (Tables 2–4).

The Severity of Inflammatory Changes in Sinus CT

The progression of inflammation in CT was described according to the Kennedy Scale (Table 1). The mean severity of inflammatory changes in the study group reached 2.37 (SD 1.10). The statistical analysis demonstrated a significant relationship between the progression of the inflammatory process and the examined intraoperative parameters (Fig. 2).

Discussion

The overview of medical literature provides little information on the effect of preoperative factors on intraoperative conditions. The analysis of the available reports indicates that mostly disease severity, comorbidities, medications used prior to surgery and a history of previous surgical treatment due to rhinosinusitis are the preoperative factors that influence surgery [10–15].

In the group of 212 patients efforts were made to determine the impact of the selected preoperative factors on the course of surgery. Among the demographic factors, age and gender were also analyzed. There was no significant relationship between the gender of patients and operating

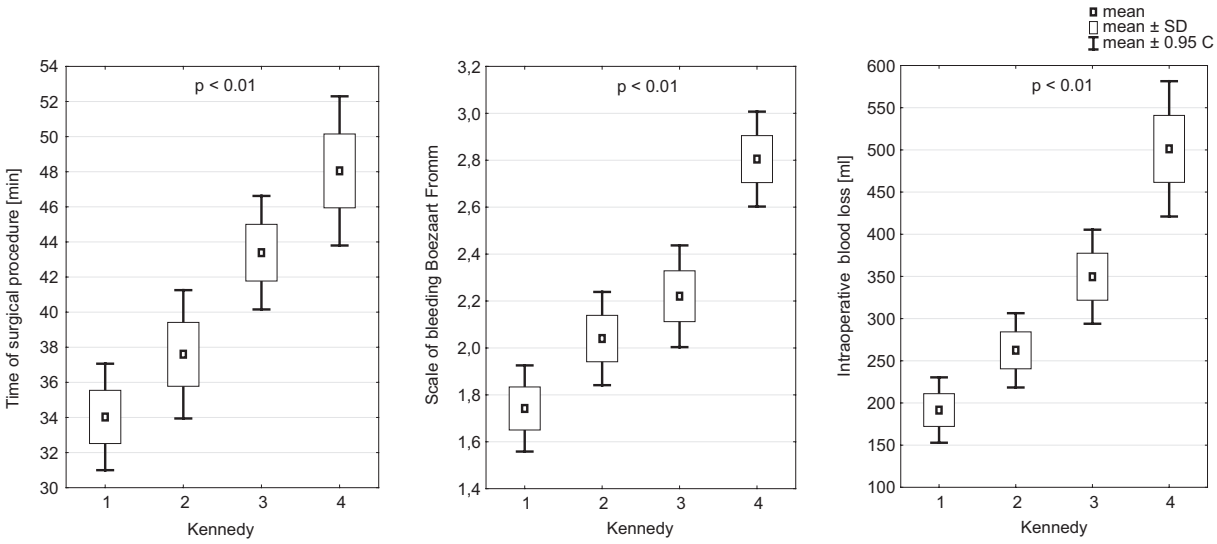

Fig. 2. The relationship between the time of surgery, intraoperative bleeding scale, blood loss during surgery and the severity of inflammation in paranasal sinuses based on the Kennedy scale

conditions. In the latter case, it was shown that operating conditions deteriorate together with the increase in age. Available studies show no relationship between the gender of patients and intraoperative conditions either [10, 15]. The same authors do not find the relationship between the age of patients and the degree of intraoperative bleeding and the duration of surgery. On the other hand, Ramadan and VanMetre, describing the population of patients over the age of 65, noticed statistically increased bleeding during the surgical procedure in this group [16]. Ban et al. also found a higher incidence of mild complications (including bleeding) in patients over the age of 65. According to the authors, this is associated with long-term symptoms of rhinosinusitis prior to surgery and diabetes occurring more frequently in patients aged over 65 [17].

As early as in 1992 Kennedy listed the severity of the disease as a major factor influencing the course of endoscopic sinus surgery and, consequently, the results of treatment [13]. These observations were confirmed by the present studies [10, 18–21].

Laguna compared three groups of patients with various severity of pathological changes before surgery based on endoscopic and imaging examination (i.e. CT). The results of these studies indicate that the worst intraoperative conditions occurred in the group of patients with the most severe rhinosinusitis and extensive nasal polyps [15].

Similarly, Albu and Baciut found a linear relationship between the severity of the disease, as described in the endoscopic examination as well as in CT of the sinuses and intraoperative bleeding in endoscopic surgery of the maxillary sinus. The analysis showed that together with the increase in the scale of disease severity, the degree of intraoperative bleeding increases, according to the scale proposed by Fromm and Boezaart [18]. In another study, Albu et al. demonstrated that chronic rhinosinusitis with nasal polyps substantially increased blood loss during the surgical procedure, decreased the quality of the operating field and extended the duration of surgery in comparison with patients without nasal polyps [20].

In the studies conducted in France, the severity of clinical changes was described according to the Lund-Mackay Scale based on CT of the paranasal sinuses. The authors confirmed the reports from other medical centres and proved that the greater the severity of the changes according to the Lund-Mackay Scale, the more significant intraoperative bleeding was [10].

The analysis of the patients in this study also showed the relationship between intraoperative conditions and disease severity. A positive correlation was found between the severity of the disease observed in CT of the sinuses as well as in nasal endoscopic examination and a worsening of intraoperative conditions. The analysis describes the relationships between individual preoperative symptoms and the course of surgery. Reports that analyse the impact of preoperative symptoms on the course of surgery have not been published in such a detailed way as yet.

Chronic rhinosinusitis and comorbidities are among the factors that deteriorate the general condition of patients prior to endoscopic surgery and may have an impact on the course of surgery and treatment results. Nair et al. are of the opinion that intraoperative bleeding is dependent on many

factors, of which advanced underlying disease, arterial hypertension, blood clotting disorders and heart diseases are the most significant [22]. Similarly, Cassano et al. demonstrated a relationship between arterial hypertension and a higher risk of perioperative bleeding. Such a relationship was not observed in diabetic patients [23]. The impact of comorbidities on operating conditions during endoscopic ethmoidectomy in patients with nasal polyps was also analysed by Mortuaire et al. The results of these studies showed no statistically significant effect on operating conditions for the diseases such as bronchial asthma, hypersensitivity to non-steroidal anti-inflammatory drugs or allergy [10].

Gromek, on the contrary, observed a greater tendency for intraoperative bleeding in patients with hypersensitivity to non-steroidal anti-inflammatory drugs [24]. The analysed material showed the influence of aspirin-induced asthma as well as cardiovascular diseases on the deterioration in intraoperative conditions. It should be noted that the presence of aspirin-induced asthma has always involved a very extensive inflammation of sinuses and the presence of nasal polyps, which could determine the results of the study.

There are several studies which indicate that also a past history of surgery due to rhinosinusitis and nasal inflammation can hinder the course of endoscopic procedures [10, 24]. Gromek noted in her studies increased intraoperative bleeding in patients with a past history of polypectomies. According to the author, it was caused by severe adhesions in the nasal cavities after previous surgery [24].

In this study a clear relationship was observed between the previous surgical treatment and the deterioration in intraoperative conditions. It seems that the deterioration in intraoperative conditions may be caused by adhesions and fibrosis of the nasal mucosa due to previous surgical procedures which narrow the operating field as well as show an increased tendency to bleeding. Lack of landmarks (e.g. the middle nasal concha, uncinate process, etc.) may increase the time of the surgical procedure, making it difficult to perform surgery and increases the risk of complications, including bleeding. Reoperations are often performed on patients with a high intensity of pathological changes. For these reasons, during the first surgery, possible reoperation should be considered. Therefore, attempts should be made to maintain the anatomical landmarks. Furthermore, before qualifying patients for reoperation, it is necessary to check if all methods of conservative treatment have been used and endoscopic examination should be performed before reoperations to evaluate the operating field conditions.

As previously shown, the severity of sinus inflammation before surgery is the most important factor that influences the course of surgical procedure. It seems that it is possible to improve operating conditions by reducing the severity of the disease prior to planned endoscopic treatment.

Glucocorticoids are the most commonly used agents prior to endoscopic paranasal sinus surgery. Sieśkiewicz et al. conducted the study on the influence of orally administered glucocorticoids on intraoperative conditions. Patients with chronic rhinosinusitis with nasal polyps and with the similar disease progression were enrolled in the study. The authors of the study report that preoperative use of oral prednisone significantly improves the quality of the surgical field and reduces surgery time [25].

On the other hand, Albu et al. conducted the study on the influence of intranasal glucocorticoids on the intraoperative conditions. The study was performed separately for patients with chronic rhinosinusitis with and without nasal polyps. The results showed decreased blood loss during surgery, improvement in the quality of the surgical field and the reduced surgery time in the groups treated with intranasal glucocorticoids both in patients with and without nasal polyps [20].

This study analysed the relationship of the past glucocorticoid treatment and intraoperative conditions. In the group of 212 patients, the agents were used intranasally in 98 (46.2%) patients, orally in 22 (10.4%), and 104 (49.1%) patients did not use the agents. The results of the analysis showed a significant deterioration in intraoperative conditions in patients who had used intranasal glucocorticoids prior to surgery. In the case of systemic glucocorticoids the differences were not statistically significant. It should be noted that the use of these agents has always been associated with extensive rhinosinusitis and often with the presence of nasal polyps, which could affect the study results. An additionally performed analysis showed yet again no relationship between systemic glucocorticoid therapy and intraoperative conditions in the study group. However, a change in the examined relationships was observed in the group of patients who used intranasal glucocorticoids. For the same stages of disease progression, intraoperative conditions did not mostly differ significantly between 2 groups. Thus, it seems that the degree of disease severity determined the study results, which are different from the data in the literature. However, it should be noted that a different methodology was used, which compared groups of patients with various stages of disease progression, unlike the above-mentioned studies of other authors. The results of the study make it possible to draw prognostic conclusions. Greater blood

loss during surgery and worse quality of the surgical field can be expected in patients who had preoperatively used intranasal glucocorticoids compared to the whole patient population undergoing endoscopic sinus surgery.

The authors concluded that selected preoperative factors and clinical parameters such as impaired nasal patency, impaired sense of smell, the presence of nasal polyps, prior surgical treatment, the presence of aspirin-induced asthma and cardiovascular diseases, a higher degree of inflammatory changes in sinuses are crucial for the course of endoscopic paranasal sinus surgery. Their presence affects the deterioration in operating conditions, the increase in intraoperative bleeding and the extended duration of surgery. Intraoperative conditions also deteriorate with the increase in the age of the patient. The knowledge of these factors and their impact on the course of surgery may provide a more thorough, multidisciplinary preparation of patients for surgery, and therefore the optimisation of operating conditions.

References

[1] **Meltzer E, Hamilos D:** Rhinosinusitis diagnosis and management for the clinician: a synopsis of recent consensus guidelines. Mayo Clin Proc 2011, 86, 427–443.

[2] **Bachert C, Hörmann K, Mösges R, Rasp G:** An update on the diagnosis and treatment of sinusitis and nasal polyposis. Allergy 2003, 58, 176–191.

[3] **Perić A, Vojvodic D, Vukomanovic-Durdevic B:** Nasal polyps with more intense epithelial eosinophil infiltration respond worse to long-term low-dose treatment by clarithromycin. Adv Clin Exp Med 2011, 20, 3, 325–334.

[4] **Fokkens W, Lund V, Mullol J:** European Position Paper on Rhinosinusitis and Nasal Polyps group. European position paper on rhinosinusitis and nasal polyps 2007. Rhinol Suppl 2007, 1–299.

[5] **Frączek M, Rostkowska-Nadolska B, Sliupkas-Dyrda E, Kuśmierz D, Pniak J, Latocha M:** The influence of vitamin D derivatives on the expression of apoptotic genes in nasal polyp fibroblasts. Adv Clin Exp Med 2010, 19, 6, 679–684.

[6] **Messerklinger W:** Endoscopy of the Nose. Baltimore: Urban-Schwarzenberg; 1978, 3, 40–44.

[7] **Wigand ME:** Endonasal sinus surgery with endoscopical control: from radical operation to rehabilitation of the mucosa. Endoscopy 1978, 10, 255–260.

[8] **Timperley D, Sacks R, Parkinson RJ, Harvey RJ:** Perioperative and intraoperative maneuvers to optimize surgical outcomes in skull base surgery. Otolaryngol Clin North Am 2010, 43, 699–730.

[9] **Misiołek M, Orłowski K, Suchodolski M, Misiołek H:** Wybrane aspekty postepowania okołooperacyjnego w chirurgii nosa i zatok przynosowych. Mag Otorynolaryngol 2012, 1, 22–26.

[10] **Mortuaire G, Bahij J, Maetz B, Chevalier D:** Lund-Mackay score is predictive of bleeding in ethmoidectomy for nasal polyposis. Rhinology 2008, 46, 285–288.

[11] **Matsuwaki Y, Ookushi T, Asaka D:** Chronic rhinosinusitis: risk factors for the recurrence of chronic rhinosinusitis based on 5-year follow-up after endoscopic sinus surgery. Int Arch Allergy Immunol 2008, 146, Suppl 1, 77–81.

[12] **Jiang RS, Su MC, Liang KL:** Preoperative prognostic factors for olfactory change after functional endoscopic sinus surgery. Am J Rhinol Allergy 2009, 23, 64–70.

[13] **Kennedy DW:** Prognostic factors, outcomes and staging in ethmoid sinus surgery. Laryngoscope 1992, 102, 1–18.

[14] **Watelet JB, Annicq B, van Cauwenberge P, Bachert C:** Objective outcome after functional endoscopic sinus surgery: prediction factors. Laryngoscope 2004, 114, 1092–1097.

[15] **Laguna D, Lopez-Cortijo C, Millan I, Gonzalez FM, Garcia-Berrocal JR:** Blood loss in endoscopic sinus surgery: assessment of variables. J Otolaryngol Head Neck Surg 2008, 37, 324–330.

[16] **Ramadan HH, VanMetre R:** Endoscopic sinus surgery in geriatric population. Am J Rhinol 2004, 18, 125–127.

[17] **Ban JH, Kwon HJ, Lee KC:** Outcomes of endoscopic sinus surgery in an elderly population: comparison with those in an adult population. Clin Otolaryngol 2010, 35, 300–306.

[18] **Albu S, Baciut M:** Failures in endoscopic surgery of the maxillary sinus. Otolaryngol Head Neck Surg 2010, 142, 196–201.

[19] **Ko MT, Chuang KC, Su CY:** Multiple analyses of factors related to intraoperative blood loss and the role of reverse Trendelenburg position in endoscopic sinus surgery. Laryngoscope 2008, 118, 1687–1691.

[20] **Albu S, Gocea A, Mitre I:** Preoperative treatment with topical corticoids and bleeding during primary endoscopic sinus surgery. Otolaryngol Head Neck Surg 2010, 143, 573–578.

[21] **Wabnitz DA, Nair S, Wormald PJ:** Correlation between preoperative symptom scores, quality-of-life questionnaires, and staging with computed tomography in patients with chronic rhinosinusitis. Am J Rhinol 2005, 19, 91–96.

[22] **Nair S, Collins M, Hung P, Rees G, Close D, Wormald PJ:** The effect of beta-blocker premedication on the surgical field during endoscopic sinus surgery. Laryngoscope 2004, 114, 1042–1046.

[23] **Cassano M, Longo M, Fiocca-Matthews E, Del Giudice AM:** Endoscopic intraoperative control of epistaxis in nasal surgery. Auris Nasus Larynx 2010, 37, 178–84.

[24] **Gromek I:** Rynologiczne aspekty astmy aspirynowej. Rozprawa doktorska. Akademia Medyczna, Warszawa, 2006.

[25] Sieśkiewicz A, Olszewska E, Rogowski M, Grycz E: Preoperative corticosteroid oral therapy and intraoperative bleeding during functional endoscopic sinus surgery in patients with severe nasal polyposis: a preliminary investigation. Ann Otol Rhinol Laryngol 2006, 115, 490–494.

Address for correspondence:

Tomasz Grzegorzek
Department of Laryngology
Medical University of Silesia
Ziołowa 45/47
40-635 Katowice
Poland
Tel.: + 48 501 291 409
E-mail: t.grzegorzek@angelius.org

Conflict of interest: None declared

Received: 29.11.2012
Revised: 18.03.2013
Accepted: 20.02.2014