ORIGINAL ARTICLE

Effect of Premedication With Systemic Steroids on Surgical Field Bleeding and Visibility During Nasosinusal Endoscopic Surgery

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KEYWORDS
Systemic steroids; Intraoperative bleeding; Surgical field; Endoscopic sinus surgery

PALABRAS CLAVE
Corticosteroides sistémicos; Sangrado intraoperatorio; Campo quirúrgico; Cirugía endoscópica nasosinusal

Abstract
Introduction: Chronic rhinosinusitis (CRS) is the inflammation of the nasal and paranasal sinus mucosa persisting for at least 12 weeks. The success of endoscopic sinus surgery (ESS) depends on minimising oedema and intraoperative bleeding. For this purpose, some surgeons advocate the use of preoperative systemic steroids (SS).

Our aim was to assess if the administration of preoperative SS in patients with CRS with or without nasal polyps (NP) facilitates the surgical procedure.

Methods: Non-randomized clinical trial is followed in CRS patients with or without NP. Patients in the ESS group received oral meprednisone preoperatively, whereas the control group did not. The visibility of the surgical field, intraoperative bleeding and surgery duration were recorded.

Results: Each group (SS group and control group) included 27 patients. The administration of SS reduced the values of all the parameters in patients without NP, with no significant differences. In patients with NP, only operative bleeding was reduced significantly.

Conclusions: Even though all the parameters decreased with the preoperative administration of SS, only operative bleeding was significantly reduced in patients with CRS with NP.

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Influencia de la premedicación con esteroides sistémicos en el sangrado y visualización del campo quirúrgico durante la cirugía endoscópica nasosinusal

Resumen
Introducción: La rinosinusitis crónica (RSC) es la inflamación de la mucosa nasal y senos paranasales de más de 12 semanas de evolución. El éxito de la cirugía endoscópica nasosinusal (CENS) para su tratamiento depende de la correcta orientación anatómica en la región, para lo cual es vital la minimización del oedema y sangrado intraoperatorio. Con este fin algunos cirujanos consideran el uso de corticosteroides sistémicos (CS) preoperatorios.


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El objetivo de este trabajo es determinar si el uso de CS administrados preoperatorios en pacientes con RSC con o sin poliposis nasal (PN) mejora las condiciones operatorias.

**Material y métodos:** Ensayo clínico controlado, no aleatorizado, en pacientes con RSC con o sin PN sometidos a CENS. Al primer grupo (CS) se le administró meprednisona por vía oral antes de la CENS. Los pacientes del grupo control no recibieron CS. Se analizaron campo quirúrgico, volumen total de sangre aspirada y duración total de la cirugía.

**Resultados:** Se incluyeron 27 pacientes en cada grupo. En pacientes con RSC sin PN la administración de corticoides disminuyó los valores de todos los parámetros en estudio, sin encontrar diferencia significativa para ninguno de ellos. En el grupo con PN solo fue estadísticamente significativa la diferencia entre el sangrado intraoperatorio.

**Conclusión:** Si bien los valores de todos los parámetros estudiados se encuentran disminuidos en alguna medida con la administración de glucocorticoides preoperatorios, solo existe una diferencia significativa con relación al sangrado intraoperatorio de pacientes con RSC con PN.

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### Introduction

Chronic rhinosinusitis (CRS) is an entity of multifactorial aetiology defined as inflammation of the nasal mucosa and paranasal sinuses, and characterised by the presence of nasal blockage, anterior or posterior rhinorrhea and olfactory alterations with over 12 weeks evolution. It can appear with or without nasal polypsis (NP). It is one of the most frequent reasons for consultation at otolaryngology centres due to its significant impact on the quality of life of patients. In the United States, an estimated 32 million adults have this diagnosis, with an annual cost of around 11.6 million dollars.\(^1\)\(^-\)\(^4\)

There are several drug treatments available to combat the disease, including antibiotics, topical or systemic anti-inflammatory agents, antihistamines, nasal irrigations, etc. Unfortunately, not all patients respond satisfactorily to medical treatment, in which case endoscopic sinus surgery (ESS) is indicated. This technique offers the advantage of excellent visualisation, with minimal tissue trauma, bleeding and morbidity. The success of the procedure and reduction of complications depend largely on a correct anatomical orientation of the region, due to the noble structures surrounding the surgical area, such as the orbit and skull base. This requires minimising oedema and intraoperative blood loss, as well as the size of the polyps.

To this end, there are various possible intraoperative strategies, such as positioning patients in the inverted Trendelenburg position, the use of local vasoconstrictors\(^5\) and intraoperative, controlled hypotension (maintaining the average blood pressure between 50 and 60 mmHg).\(^6\) However, these manoeuvres are often insufficient, possibly due to the intense inflammatory and hyperplastic changes and polypoid lesions in the nasal and sinus area present in CRS. For such reasons, some surgeons consider the use of preoperative systemic corticosteroids (SSs).\(^7\) This practice reduces oedema and inflammation of the mucosa and the size of polyps, and also minimises bleeding, thus optimising surgical field visibility and, therefore, facilitating the intervention. Moreover, Griffies et al.\(^8\) pointed out that the spasmodic effect of local vasoconstrictors is prolonged by the simultaneous use of SS, which is especially significant in cases of severe inflammation or polypsis, in which arteriolar bleeding is added to capillary bleeding.

The mechanism by which SS reduce inflammation and oedema in CRS is through their wide variety of anti-inflammatory and immunosuppressive effects, such as inhibition of neutrophil and monocyte migration, decrease of antigen presentation by macrophages and lymphocytes, reduction of lymphocyte proliferation, activation and differentiation, and reduction of cytokine production.\(^9\) On the other hand, decreased intraoperative blood loss is explained by an increase in the effects of endogenous noradrenaline and adrenaline,\(^10\) as well as an increase in spastic reactivity of the vascular smooth muscle,\(^11\) thereby affecting vasoconstriction in microcirculation, and thus reducing capillary bleeding.

The use of SS at high doses for long periods involves a series of adverse effects ranging from mild (mood swings, gastric irritation) to severe (Cushing syndrome, arterial hypertension, peptic ulcer, diabetes, etc.\(^12\) ). However, with regard to their use in a short preoperative period, the relevant side effects described involve alterations in tissue repair, immunocompromise with increased risk of surgical site infection and avascular necrosis of the femoral head.

Despite the fact that most authors suggest the use of SS for the treatment of CRS,\(^7\)\(^,\)\(^13\)\(^,\)\(^14\) and the existence of some research on its use as premedication in ESS, there is no evidence on the influence of this practice which compares patients with and without NP, which is why the main goal of this work is to determine whether the use of SS administered prior to endoscopic sinus surgery in patients suffering CRS, with or without NP, improves intraoperative bleeding, visualisation of the surgical field and duration of surgery.

### Materials and Methods

We conducted a non-randomised, controlled clinical trial among patients with CRS, with or without NP, who underwent endoscopic sinus surgery in the period between May and October 2011.
The diagnosis of CRS was obtained clinically (symptoms of nasal blockage, anterior or posterior rhinorhoea and olfactory alterations of more than 12 weeks evolution), with complementary video-fibrolaryngoscopy (mucosal oedema and hyperemia, polyposis, purulence in the middle meatus or alterations of the ostiomeatal complex) and a computed tomography (CT) scan of the paranasal sinuses (with evidence of ostiomeatal complex blockage and total or partial mucosal thickening of the paranasal sinuses).

We included in the study those patients aged over 16 years with a Lund-Mackay score greater than or equal to 4, with or without NP, in whom medical treatment failed (defined as the administration for at least 3 months of 400 μg/day of fluticasone propionate and 4 weeks of 500 mg/day of clarithromycin, or at least 2 courses of 30 mg/day meprednisone for 3 days, followed by maintenance of 5 mg/day for a further 10 days), and were, therefore, referred for nasal endoscopic surgery.

In each case we recorded age, gender, medical history of relevance (diabetes, hypertension, asthma, etc.), as well as sinonasal symptoms reported by the patient at the time of surgery (nasal blockage, congestion, facial pain or fullness, impaired sense of smell, rhinorhoea and purulence in the middle meatus) classified as mild, moderate or severe according to their intensity. We graded NP between 0 and 3 according to the Johansson et al. scale (based on the percentage projection of polyps on the lateral wall, and the percentage of the nasal cavity occupied by polyps). For data analysis purposes, we included those patients in the nasal polyposis group who had at least grade 1 in either nostril. In addition, we also noted the Lund-Mackay tomographic score for the determination of disease stage (Tables 1 and 2, respectively).

The exclusion criteria established were the following: immunocompromised patients, congenital or acquired mucociliary alterations (primary ciliary dyskinesia, cystic fibrosis, etc.), allergic fungal rhinosinusitis confirmed by anatmorphological and mycological studies, and prior ESS.

Patients were divided into 2 groups. The SS group was administered 30 mg of oral meprednisone divided into 2 daily doses for 5 consecutive days prior to ESS. Patients in the control group received no SS for at least 2 months prior to the surgery. The allocation of patients to each group was based on the possibility of administering SS, taking into account the general characteristics of each case and regardless of the severity of the rhinosinusal symptoms. That is, we included in the control group those patients with an absolute contraindication for use of SS, such as arterial hypertension, diabetes, narrow or broad angle glaucoma, gastritis or peptic ulcer, known hypersensitivity to meprednisone or any of the excipients and liver pathologies. There were some diabetic and hypertensive patients in the corticosteroid group, since the administration had been authorised by their physician, after considering their base pathology as mild. The ESS procedures were all performed by the same surgeon, who was unaware of the group to which each patient belonged at the time of surgery.

Both groups were preoperatively prepared in the same manner: the use of corticosteroid nasal sprays was suspended at least 3 weeks prior to the procedure, swabs with topical vasoconstrictors (oxymetazoline) were placed on both middle meatuses 15 min before starting the surgery, patients were placed in the reverse Trendelenburg position and they were administered the same anaesthetic medication, with induction of 2% propofol (2 mg/kg) as hypnotic and vecuronium (0.008 mg/kg) as muscle relaxant. Maintenance of anaesthesia was performed with sevoflurane (0.5–1.5 vol%) and remifentanil, maintaining mean arterial pressure between 60 and 75 mmHg.

We analysed the following 3 parameters during surgery: surgical field according to the 6-point scale by Fromme et al. and Boezaart et al. (Table 3), obtaining a mean value for the observation noted by the surgeon every 15 min; total blood volume collected in millilitres (obtained from the vacuum collector); and total duration of the surgery in minutes (considering its start upon introduction of the endoscope into the nasal cavity and its end upon placement of the nasal blockage).

The research was approved by the Training and Ethics Committee of our institution. All patients were informed about the research and filled out an informed consent form before the surgical intervention.

Lastly, we used the 11th edition of the software package SPSS to perform the statistical analysis. We used the chi-square test for the comparison of proportions between groups. We considered as statistically significant a value of \( P < .05 \).

### Results

For this study we recruited 54 patients undergoing ESS, half of which (n=27) were administered SS prior to surgery (SS group), while the other half (n=27) were not given any premedication (control group). In turn, both groups were divided according to whether they presented CRS with or

### Table 1 Johansson Scale of Nasal Polyposis Levels.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absence of NP</td>
</tr>
<tr>
<td>1</td>
<td>NP only in the middle meatus</td>
</tr>
<tr>
<td>2</td>
<td>NP beyond the middle meatus but without completely obstructing the nasal cavity</td>
</tr>
<tr>
<td>3</td>
<td>NP completely obstructing the nasal cavity</td>
</tr>
</tbody>
</table>

NP: nasal polyposis.

### Table 2 Lund-Mckay Tomographic Classification of Rhinosinusitis.

<table>
<thead>
<tr>
<th>Sinus</th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary</td>
<td>0–2</td>
<td>0–2</td>
</tr>
<tr>
<td>Anterior ethmoid</td>
<td>0–2</td>
<td>0–2</td>
</tr>
<tr>
<td>Posterior ethmoid</td>
<td>0–2</td>
<td>0–2</td>
</tr>
<tr>
<td>Sphenoid</td>
<td>0–2</td>
<td>0–2</td>
</tr>
<tr>
<td>Frontal</td>
<td>0–2</td>
<td>0–2</td>
</tr>
<tr>
<td>Ostiomeatal complex</td>
<td>0–2</td>
<td>0–2</td>
</tr>
</tbody>
</table>

0: without abnormalities; 1: partial opacification; 2: total opacification.

*a* 0: not occluded; 2: occluded.
without nasal polyps (CRS with and without NP, respectively).

Table 4 shows the number and general characteristics of patients in each group, showing that both groups were similar regarding age, gender, diabetes and asthma. We found a higher percentage of patients with arterial hypertension in the control group (with and without NP) than in the SS group (47.1% and 30% vs 21.4% and 19.6%, respectively). Only 13 patients in both groups presented bronchial asthma, of which 7 belonged to the SS group and 6 to the control group.

Regarding the Lund-Mackay scale, we noted that patients with NP obtained a higher score than those without NP. We found no significant differences between the SS and control groups.

Regarding the rhinosinusal symptoms reported by patients, we found a greater number of patients who were identified with "severe" the symptoms of nasal blockage, nasal congestion and olfactory alterations in the NP groups, whereas rhinorrhea and purulence in the middle meatus were reported as "mild". In contrast, the majority of patients without polyps reported the intensity of their symptoms as "mild" and "moderate". The degree of NP in these patients according to the Johansson scale was recorded upon physical examination. No significant differences between groups were found. These results are shown in Table 5.

**Patients With Chronic Rhinosinusitis and Without Nasal Polyposis**

Intraoperative measurements noted a mean volume of bleeding of 94.62 ml for the SS group, whereas in the control group this was 101.9 ml. This difference was not statistically significant (P=.09). The visualisation of the surgical field on the scale of Boezaart et al. also found a lower score for the SS group (2.28) than for the control group (2.61), with a value of P=.39. The total duration of surgery was 5.3 min less for patients in the SS group. In summary, patients without polypoid symptoms presented decreased values for all variables under study. However, these differences were not statistically significant.
Table 4  General Characteristics for Each Group.

<table>
<thead>
<tr>
<th></th>
<th>CRS with nasal polyposis</th>
<th>CRS without nasal polyposis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SS group</td>
<td>Control group</td>
</tr>
<tr>
<td>No.</td>
<td>14</td>
<td>17</td>
</tr>
<tr>
<td>Female gender, %</td>
<td>28.6</td>
<td>35.3</td>
</tr>
<tr>
<td>Male gender, %</td>
<td>71.4</td>
<td>64.7</td>
</tr>
<tr>
<td>Age, years</td>
<td>46.07 (±12.2)</td>
<td>46.88 (±19)</td>
</tr>
<tr>
<td>AHT, %</td>
<td>21.4</td>
<td>47.1</td>
</tr>
<tr>
<td>DBT, %</td>
<td>11.8</td>
<td>35.3</td>
</tr>
<tr>
<td>Asthma, %</td>
<td>28.6</td>
<td>17.6</td>
</tr>
<tr>
<td>Lund Mckay score</td>
<td>11.79</td>
<td>12.82</td>
</tr>
</tbody>
</table>

AHT: arterial hypertension; CRS: chronic rhinosinusitis; DBT: diabetes mellitus; SS: systemic corticosteroids.

Table 5  Grade of Nasal Polyposis According to the Johansson Scale.

<table>
<thead>
<tr>
<th>Grades</th>
<th>Left Nasal Fossa</th>
<th>Right Nasal Fossa</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>SS</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>Control</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>P</td>
<td>.26</td>
<td>.18</td>
</tr>
</tbody>
</table>

SS: systemic corticosteroids.

0 or 1. No patient in the SS group developed perioperative adverse reactions to the administration of the drug.

Discussion

Establishing an adequate surgical field during ESS is essential. Excessive bleeding during this procedure not only makes it more technically difficult, but also increases the incidence of complications, including intraorbital bleeding, damage to the optic nerve and extraocular musculature, dural injury with entry into the intracranial space and cerebrospinal fluid fistulas, resulting in increased risk of meningitis. Furthermore, tissue damage is more likely to occur under low visibility conditions, and may even lead to failure of the surgery.

The present study is a clinical trial aimed at determining the effect of premedication with SS in intraoperative bleeding, visualisation of the surgical field and surgical time in patients undergoing ESS for treatment of CRS, with or without NP. While we considered patients with NP as a subgroup within CRS, we decided to analyse them separately due to histological, clinical and surgical differences.

With regard to blood loss, this research found that administration of meprednisolone before surgery decreased it in both groups of patients. However, it only did so in a statistically significant manner among rhinosinusitic patients with NP. This could be due to the histopathological differences between both groups: while in CRS patients without polyposis the predominant inflammatory cells are neutrophils, CRS patients with nasal polyposis present a more intense inflammatory response associated mainly to eosinophils. According to various investigations, the efficacy of glucocorticoids in airway pathologies is partly dependant on their ability to reduce infiltration of airways by eosinophils (thus preventing an increase in their viability and hindering their activation). Their administration before surgery would produce a decrease in the size of the polyps and in the tendency of the nasal mucosa to form an oedematous reaction in response to trauma during the procedure, thereby increasing the available space in the nasal cavity, optimising the general surgical conditions, with better management of the endoscope and

Table 6  Mean Values of Intraoperative Bleeding, Total Surgical Time and Quality of the Surgical Field.

<table>
<thead>
<tr>
<th>Variables</th>
<th>CRS with polyposis</th>
<th>CRS without polyposis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SS</td>
<td>Control</td>
</tr>
<tr>
<td>Intraoperative bleeding, ml</td>
<td>139.6</td>
<td>171.1</td>
</tr>
<tr>
<td>Total surgical time, min</td>
<td>92.29</td>
<td>97.35</td>
</tr>
<tr>
<td>Quality of the surgical field</td>
<td>2.21</td>
<td>3.59</td>
</tr>
</tbody>
</table>

CRS: chronic rhinosinusitis; min: minutes; ml: millilitres; SS: systemic corticosteroids.
evacuation of secretions, and thus reducing intraoperative bleeding.

Similar data were analysed in a prospective investigation conducted by Nair et al., which assessed the effect of beta-blockers as premedication in ESS (without differentiating between CRS with or without NP). The study concluded that there was no significant difference in intraoperative bleeding between both groups. This work also reported a mean blood loss of 150 ml for the beta-blocker group and 200 ml for the control group. These values were similar to those obtained for our patients with NP, but higher than those for the group without NP.

In our work, the quality of the surgical field also showed lower values for premedicated patients (with and without NP), but this difference was not statistically significant. This was the only variable in the study that could be affected by the subjectivity of the surgeon, thus making its result questionable. The total duration of surgery was longer in patients with polypoid pathology, with a difference of about 5 min between patients with and without preoperative mepradinosone, although this datum was not statistically significant. These findings disagreed with those derived from the research conducted by Sieskiewicz et al., in which similar parameters to those in our study were evaluated among 36 patients with NP undergoing ESS. This study obtained statistically significant results for surgical time and field, but not for overall intraoperative bleeding.

Finally, as a potential limitation of our study, we should note the criterion for the allocation of patients to each group, as their general characteristics may have influenced the final outcome. Moreover, we should also reconsider whether the dose of mepradinosone employed (30 mg/day in 2 daily doses for 5 consecutive days) was sufficient to achieve a significant anti-inflammatory effect. There is strong evidence in the literature regarding the dose of corticosteroids to be used for this type of intervention. We selected this dose because it was considered to be moderate and believed sufficient to achieve the desired surgical effect, without triggering adverse effects associated with higher doses (50 or 60 mg). According to the literature reviewed, the adverse effects of the use of SS, such as suppression of the hypothalamic-pituitary axis, are caused by long-term use of supraphysiological doses or abrupt termination thereof. We did not find any reference or details on the number of daily doses.

Conclusion

The hypothesis for the use of SS as premedication in ESS for the treatment of CRS is that they should facilitate surgery by reducing bleeding and improving visualisation of the surgical field, thereby reducing surgical time. The results of this research showed that, although the values of all the parameters studied (bleeding, surgical field and duration) decreased to some extent with the preoperative administration of steroids, there was only a significant difference in relation to intraoperative bleeding of CRS patients with NP. In conclusion, due to the low significance between the groups compared, administration of mepradinosone prior to ESS should be limited to specific cases, and would only be justified in order to improve the surgical conditions of CRS patients with NP.

Conflict of Interests

The authors have no conflict of interests to declare.

References