Original Investigation

Preoperative Use of Dexamethasone in Rhinoplasty
A Randomized, Double-blind, Placebo-Controlled Clinical Trial

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IMPORTANCE Postoperative edema and ecchymosis following rhinoplasty are a cause of anxiety for both patients and physicians and can affect the cosmetic results. Corticosteroids have been used to reduce these events.

OBJECTIVE To determine whether preoperative use of dexamethasone sodium phosphate alters the occurrence of edema and ecchymosis following rhinoplasty.

DESIGN, SETTING, AND PARTICIPANTS Randomized, double-blind, placebo-controlled clinical trial at an institutional referral center among a sample of individuals with rhinomegaly.

INTERVENTIONS Patients were randomized into 2 groups. In group 1, dexamethasone was intravenously injected before surgery. In group 2, normal saline solution was intravenously injected before surgery.

MAIN OUTCOMES AND MEASURES When patients returned at 1 week after surgery, standardized photographs were obtained. The photographs were analyzed by 5 plastic surgeons who were blinded as to whether dexamethasone or normal saline solution had been injected. The plastic surgeons rated the degree of edema and ecchymosis.

RESULTS Forty-two patients participated in the study. Randomization by lottery resulted in 20 patients in group 1 and 22 patients in group 2. Group 1 showed lower rates of postoperative ecchymosis than group 2; the difference of 0.62 (P = .02) reflects less perceived ecchymosis when dexamethasone was administered. Group 1 also showed lower rates of postoperative edema than group 2; the difference of 0.68 (P = .01) reflects less perceived edema when dexamethasone was administered.

CONCLUSIONS AND RELEVANCE Preoperative use of dexamethasone reduced edema and ecchymosis at 7 days after rhinoplasty. Rigorous methods in this trial demonstrate the beneficial effect of preoperative corticosteroid administration in this surgical procedure.

LEVEL OF EVIDENCE 1.

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Rhinoplasty is one of the most common cosmetic surgical procedures performed. Postoperative edema and ecchymosis following rhinoplasty are a cause of anxiety for both patients and physicians and can affect the cosmetic results.[1,2]

Consequently, many researchers have proposed methods to eliminate or decrease these postsurgical effects. Corticosteroids have been used in maxillofacial and plastic surgery to reduce postoperative edema and ecchymosis.[3,4] Their use is thought to reduce postoperative swelling and shorten the recovery time.[5] Data are conflicting on the efficacy of routine systemic corticosteroid administration in rhinoplasty, with debate continuing on the long-term benefit of routinely administering intraoperative or postoperative corticosteroids in patients undergoing rhinoplasty.[4-6] The objective of this study was to determine whether preoperative use of dexamethasone alters the occurrence of edema and ecchymosis following rhinoplasty.

Methods

This study was designed as a randomized, double-blind, placebo-controlled clinical trial. The research protocol was approved by the hospital research ethics committee and is registered with the Brazilian Information System on Research Ethics Involving Humans (identifier 0007.0.005.000-03). Detailed information about the study was given to the participants, and written informed consent was obtained. All aspects of the study were conducted in accord with the tenets of the Declaration of Helsinki.

Inclusion criteria for the study were rhinomegaly, normal hematological and cardiopulmonary screening test results, and written consent expressing agreement to participate following explanation of the study by one of us (D.S.V., L.A.C., or G.B.B.). Exclusion criteria for the study were acne, combined surgery, systemic arterial hypertension, need for septoplasty in conjunction with diabetes mellitus, or history of peptic ulcer or the use of dermal fillers in the nose.

Patients were randomized into 2 groups. In the first group, 2.5 mL of dexamethasone sodium phosphate (4 mg/mL) was intravenously injected before surgery. In the second group, 2.5 mL of 0.9% normal saline solution was intravenously injected before surgery.

All procedures were performed with endotracheal intubation using total intravenous anesthesia by continuous infusion of remifentanil hydrochloride (14-20 µg/h) and propofol (4-6 mg/kg/h). Atracurium besylate (5 mg) was administered every 20 minutes. All patients received metoclopramide hydrochloride (10 mg) intravenously. At the end of the operation and before extubation, the muscle relaxants were reversed with neostigmine methylsulfate (0.35 mg/kg) and atropine sulfate (0.175 mg/kg). These anesthetic procedures are frequently used in rhinoplasty.[7]

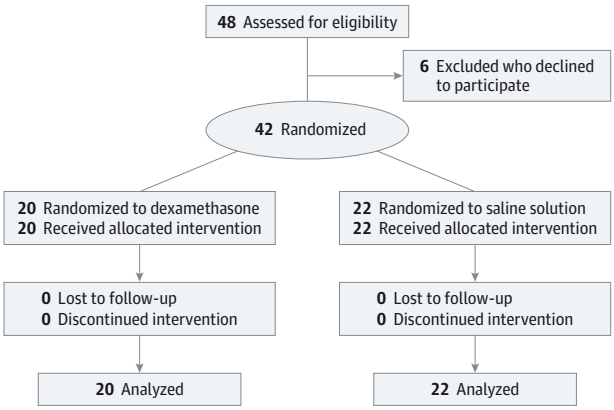
In addition, 10 mL of 2% lidocaine containing 1:200 000 epinephrine was administered according to the technique recommended by Pitanguy.[8] This infiltration starts in the glabella, reaching the entire dorsum and sidewalls of the nose, and then seeps along the membranous septum from the tip to the nasal spine. Next, the solution is injected into the intranasal mucosa, along the septum, and into the soft-tissue envelope. Oxymetazoline hydrochloride–soaked cotton and felt pledgets were inserted into the nasal cavities for mucosal constriction. A waiting time of 20 minutes was observed before incision.

In all patients, a closed approach was used with an intercolumellar incision and resection of the depressor muscle of the nasal septum. A transcartilaginous bilateral incision of the alars 6 mm from the caudal margin of the lateral middle crura was performed. The cartilage was exposed for resection by dissecting the vestibular skin off the cartilage. Dieresis of the lower lateral cartilage with extension to the nasal dorsum was performed to expose the nasal structures. The perichondrium was opened by a single incision in the midline of the upper lateral cartilage, with detachment of the perichondrium in continuity with the periosteum of the nasal bone. On the subperichondrial and subperiosteal plane under direct sight, the osteocartilaginous hump was assessed. Bone resection was performed with a down-biting diamond rasp, and septal cartilage was resected with a scalpel blade. Resection of the caudal portion of the septum, a lateral osteotomy with low-to-low fracture, closing of the mucosa with simple stitches of polyglactin 5.0, and application of a dressing with microporous tape were the final steps of the procedure.

Postoperative analgesics included dipyrone (8 mg/kg) intravenously every 6 hours) and tenoxicam (0.3 mg/kg) intravenously every 12 hours, with meperidine hydrochloride (0.5 mg/kg) intravenously every 3 hours as needed. The procedures were performed in a hospital operating room, with the immediate postoperative period in the recovery room of the unit. No antibiotics or corticosteroids were administered after surgery. The head was held high, and the patient was instructed to use cold compresses for 48 hours. All data related to the procedure and those regarding preoperative and postoperative follow-up were recorded using a specific protocol.

When patients returned at 1 week after surgery, standardized high-quality photographs were obtained.[9] The photographs were analyzed by 5 plastic surgeons (authors) who did not participate in the procedures and were blinded as to whether dexamethasone or normal saline solution had been administered to the patients. They rated the degree of edema and ecchymosis using a scale proposed by Kara and Gökalan.[10] This scale assigns points for the presence of ecchymosis according to the affected area as follows: 0 for none, 1 for medium, 2 for to the line of the center of the pupil, 3 for passed the line of the center of the pupil, and 4 for to the lateral corner of the eye. The scale assigns points for the presence of edema as follows: 0 for none, 1 for minimum, 2 for to the iris, 3 for reaches the pupil, and 4 for closes the eyes. The scores of the 5 observers were then averaged by discarding the high and low values and averaging the remaining 3. When 2 or more scores were the same high and low values, we discarded 2 of them and used the remaining 3 to obtain the average score. At the end of data collection, the pharmacist revealed the randomization (dexamethasone or normal saline solution) for the statistical analysis.

Figure 1. CONSORT Flowchart



We estimated the sample size needed based on a 30% difference between groups in postoperative edema and ecchymosis with 35% to 40% variation. On the basis of these assumptions, 15 patients per group was required to achieve 80% power at α = .05. The sample size calculation was based on α = .05 with an estimated 80% power using the PS software program (Power and Sample Size Calculation; http://biostat.mc.vanderbilt.edu/wiki/Main/PowerSampleSize).

Patients had been randomized into 2 groups using statistical software (SAS, version 8.2; SAS Institute Inc) at a ratio of 5 to obtain a sample size of 40. $P < .05$ was considered statistically significant. All P values reported are 2-tailed. We used another software package (SPSS, version 20; IBM Corporation) for all statistical analyses. Mann-Whitney test was used when the 2 samples had the same scale parameter value, t test was used when the statistical units underlying the 2 samples being compared were nonoverlapping, and χ^2 test was used to examine differences in categorical variables.

Results

Forty-two patients participated in the study. Randomization by lottery resulted in 20 patients in group 1 and 22 patients in group 2. All patients returned for follow-up on the indicated day. **Figure 1** shows the Consolidated Standards of Reporting Trials flowchart.[11]

The 2 groups were not statistically significant different in terms of patient age, sex, duration of surgery, body mass index, smoking status, and duration of the postoperative period. These results are summarized in **Table 1**.

Group 1 showed statistically significant lower rates of postoperative ecchymosis than group 2 (**Table 2**). The difference of 0.62 (P = .02) reflects less perceived ecchymosis when dexamethasone was administered.

Group 1 also showed statistically significant lower rates of postoperative edema than group 2 (Table 2). The difference of 0.68 (P = .01) reflects less perceived edema when dexamethasone was administered.

No epistaxis or hematoma that required tamponade or reoperation occurred during the study period. No major complications were seen. **Figures 2** and **3** show typical preoperative and postoperative views of dexamethasone participants.

Table 1. Variables Studied[a]

Variable	Value	*P* Value
Age, mean (SD), y	23.12 (5.09)	.41
Male sex, %	7.1	.32[b]
Duration of surgery, mean (SD), min	50.17 (6.62)	.55
White race/ethnicity, %	100	NA
BMI, mean (SD)	22.02 (1.89)	.39
Smoking, %	11.9	.51[b]
Duration of postoperative period, mean (SD), d	6.8 (0.71)	.44

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); NA, not applicable.

[a] No between-group differences were observed for any of the variables.

[b] By χ^2 test. All other comparisons are by t test.

Table 2. Ecchymosis and Edema Results

Group	Mean (SE)	95% CI	*P* Value[a]
Ecchymosis Results			
1	1.56 (0.13)	1.30-1.83	NA
2	2.18 (0.13)	1.91-2.45	NA
Difference	0.62 (0.19)	0.23-0.99	.02
Edema Results			
1	1.36 (0.13)	1.09-1.63	NA
2	2.04 (0.13)	1.77-2.30	NA
Difference	0.68 (0.19)	0.28-1.06	.01

Abbreviation: NA, not applicable.

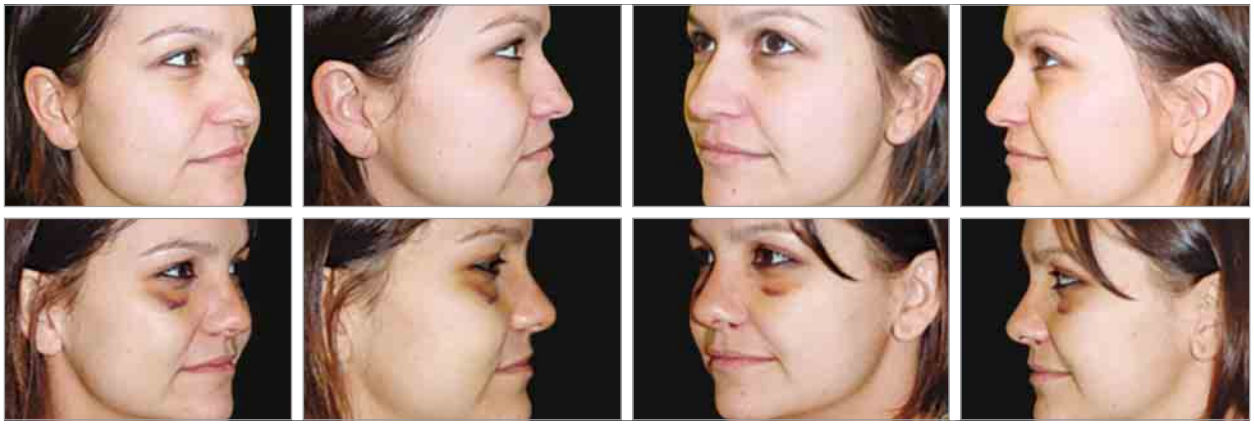
[a] By Mann-Whitney test.

Discussion

In 2013, rhinoplasty was the second most frequently performed surgical cosmetic procedure in the United States.[12] Postoperative edema and ecchymosis are commonly reported after facial plastic surgery.[3] Their occurrence following rhinoplasty is disturbing and sometimes frightening for patients and their families.[13] Edema and ecchymosis after rhinoplasty make early social interaction difficult. Palpebral edema can temporarily obstruct vision, and periorbital ecchymosis may result in increased permanent pigmentation.[14] Several factors contribute to the onset of edema and ecchymosis, and efforts to reduce these events have focused on preoperative, perioperative, and postoperative medications, as well the use of various osteotomy techniques. This study sought to determine only the effect of preoperative dexamethasone use.

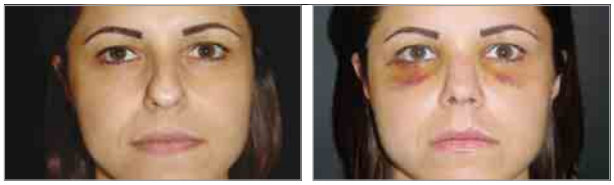
Corticosteroids may be administered at various doses during rhinoplasty. They can decrease swelling by reducing vascular permeability, diminishing inflammatory metabolites, and inhibiting migration of lymphocytes and neutrophils. Despite these efforts, the final results are variable. Moreover, the adverse effects and contraindications of these drugs may prevent their widespread use.[15] Because a single dose of a glucocorticoid (even a large one) may be used without harmful ef-

Figure 2. A 23-Year-Old Woman Before and After Surgery



Four views before surgery (top row), each with its corresponding view at 7 days after surgery (bottom row).

Figure 3. A 30-Year-Old Woman Before and After Surgery



Before surgery (left) and at 7 days after surgery (right).

fects, some surgeons prefer to administer corticosteroids in a single dose. Dexamethasone sodium phosphate (10 mg) is one of the most potent anti-inflammatory corticosteroids, the onset is fast, and its effects are moderately long-lasting. It has a biological half-life of 72 hours.[16] These characteristics led us to evaluate the use of this dexamethasone dose in the present study.

Kara and Gökalan[10] found that preoperative or postoperative use of single-dose dexamethasone in rhinoplasty significantly decreased upper and lower eyelid edema and upper eyelid ecchymosis for the first 2 days after surgery compared with a placebo. However, the effect of dexamethasone had abated after the first 2 days, and its use did not shorten the recovery period. In a meta-analysis, Youssef et al[5] found that perioperative corticosteroid use significantly reduced postoperative edema of the upper and lower eyelids on the first and third days after surgery, with no significant effect after the third day. They concluded that corticosteroids should be administered to patients undergoing rhinoplasty to decrease periorbital edema after surgery during the first 3 days. Our study demonstrates that preoperative administration of dexamethasone reduces both edema and ecchymosis up to the seventh day after rhinoplasty.

Based on another meta-analysis, Hatef et al[17] concluded that perioperative corticosteroid use decreases postoperative edema and ecchymosis associated with rhinoplasty and stated that preoperative administration is superior to postoperative administration. Their study supports our findings regarding preoperative dexamethasone administration.

In a systematic review of corticosteroid use in cosmetic plastic surgery, Pulikkottil et al[3] found no associated statistically significant long-term decrease in postoperative edema or ecchymosis after rhinoplasty, although significant reductions were noted in the short term (<2 days). In our study, edema and ecchymosis were assessed at 7 days after the procedure, and our results reflect the long-lasting effects of preoperative dexamethasone administration. The seventh postoperative day was chosen for review because this is when ecchymosis most frequently appears. It is also a convenient time for evaluation because the bandage is removed on this day, and most patients schedule their professional leave of absence for a period of 1 week.[18]

In standard rhinoplasty procedures, the osteotomy techniques cause a significant amount of periorbital swelling due to the trauma of fracturing the nasal bones. Theoretically, the anti-inflammatory properties of corticosteroids result in diminished vascular permeability, leading to less exudation and decreased edema.[19]

Ecchymosis following rhinoplasty is usually caused by injury to angular vessels that cross the osteotomy sites. The onset of ecchymosis in the skin varies with the amount of extravasated blood and its residue at the lesion site. If not evacuated, an ecchymosis usually migrates from the deep planes to the surface planes and may not be present at the time of injury but can appear in the subsequent days.[20]

Habal[21] concluded that standardized evaluations in surgery are difficult to achieve because of the numerous variables among patients. In the present study, all surgical procedures were performed by the same surgeon (D.S.V.) and the same anesthesiologist with the same equipment, medications, instruments, and techniques, in an attempt to minimize sources of bias. Therefore, the external validity of this study is limited to closed rhinoplasty with external osteotomy.

The initial sample size calculation estimated that 15 patients per group would be sufficient to achieve 80% power at $\alpha = .05$. However, 42 patients were ultimately enrolled in the study. This is because the randomization process was calculated at a ratio of 5 to 1, and we increased the study population to prevent loss to follow-up. By increasing the sample size, we decreased the width of our 95% CI, and this increased our

internal validity.[22] Our study has experienced no loss to follow-up, probably because the observation period ended on the same day as when the bandage was removed. Therefore, the population studied exceeds the sample size calculated.

Rhinoplasty can be performed using general anesthesia with endotracheal intubation or using intravenous sedation with local anesthesia, depending on patient characteristics and surgeon preference. With general anesthesia and endotracheal intubation, it is easier to secure the airway and prevent intragastric blood, which leads to postoperative nausea and vomiting, by using a throat pack. Lidocaine and epinephrine injection in the highly vascular areas of the nose, including the columella, tip, dorsum, lateral sidewalls, alar base, and along the caudal margin of the lower lateral cartilage, is important for hemostasis.[23] For these reasons, general anesthesia was elected for our study.

Discarding the high and low scores and averaging the remaining values is a statistical procedure used to avoid analytical bias. Our results showed that the study groups had similar possible confounding factors. Therefore, the findings reflect real outcomes of the treatment and demonstrate that preoperative administration of dexamethasone reduces eyelid edema and ecchymosis in the first week after surgery. Our overall results are compatible with earlier evidence that confirms the positive effect of corticosteroid use in rhinoplasty. More randomized clinical trials are needed to investigate the effects of the timing and dose of corticosteroids administered after rhinoplasty on postoperative edema and ecchymosis.

Conclusions

Based on the measures used and the clinical data collected herein, preoperative use of dexamethasone reduced edema and ecchymosis at 7 days after rhinoplasty performed using general anesthesia. Rigorous methods in this trial demonstrate the beneficial effect of preoperative corticosteroid administration in this surgical procedure.

ARTICLE INFORMATION

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Author Contributions: Dr Valente had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Valente, Steffen, Carvalho, Borille, Zanella.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Valente, Steffen, Carvalho, Borille, Zanella.
Critical revision of the manuscript for important intellectual content: Valente, Steffen, Carvalho, Zanella, Padoin.
Statistical analysis: All authors.
Administrative, technical, or material support: Steffen, Carvalho, Borille, Zanella, Padoin.
Study supervision: Valente.

Conflict of Interest Disclosures: None reported.

Additional Contributions: This randomized, double-blind, placebo-controlled clinical trial was conducted at Santa Casa Hospital, Porto Alegre, Brazil.

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