Corticosteroid Use in Cosmetic Plastic Surgery

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Background: Steroids have been used in cosmetic plastic surgery to reduce postoperative edema and ecchymosis. We performed a systematic review of the literature addressing postoperative steroid use after rhinoplasty. Due to a paucity of studies, a review of the literature was also performed for postoperative steroid use in rhytidectomy and body contouring surgery.
Methods: An exhaustive literature search was performed using: MEDLINE, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, and PubMed. A total of 12 articles were chosen to be included in the rhinoplasty systematic review. Cohen's kappa for level of agreement between the two reviewers was 1.0. Data recorded from each of the studies included: author, year, sample size, age, follow-up, statistical analyses, eyelid/edema assessment, significant findings, *p* values, and steroid regimens. A general review of the current rhytidectomy and body contouring literature associated with corticosteroids was performed as well.
Results: No statistically significant long-term reduction in postoperative edema or ecchymosis after rhinoplasty. Significant reductions were noted in the short term (<2 days). Review of the rhytidectomy literature described no significant decrease in postoperative edema or ecchymosis. Steroid use was noted to reduce postoperative nausea and vomiting when combined with other therapies in body contouring.
Conclusions: Steroid use is not warranted in the postoperative period and only reduces transient edema and ecchymosis. A significant benefit for steroid use after rhytidectomy is not evident as well. Steroid use may benefit in postoperative nausea and vomiting. (*Plast. Reconstr. Surg.* 132: 352e, 2013.)

The American Society for Aesthetic Plastic Surgery reported that, in 2011, approximately 9 million surgical and nonsurgical cosmetic procedures were performed, marking an over 197 percent increase since 1997. Of these procedures, 126,107 rhinoplasties were performed, making rhinoplasty number six among the top surgical procedures. Rhytidectomies ranked number five, with 116,086 procedures performed, and the number one procedure performed was lipoplasty, with an impressive 325,332 procedures performed in 2011.[1] With such ubiquity, these procedures have been visible cosmetic mainstays of current plastic surgery and thus prevention of untoward events such as bleeding, edema, and ecchymosis is of paramount importance.

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Although these aforementioned postoperative phenomena are expected to a certain degree, their persistence can affect patient satisfaction and cosmetic results. Unsightly swelling and bruising may disturb and frighten patients.[2] Palpebral edema can potentially affect vision, especially within the first 24 hours.[3] Ecchymosis can persist and lead to eventual periorbital hyperpigmentation.[4] With rhinoplasty, for example, local trauma to the nasal anatomy appears to serve as the root of the problem.

The nose naturally has a subcutaneous plane and a deep areolar plane as evidenced by histopathologic examination.[5,6] Edema and ecchymosis are the direct result of the inability of the lymphatic and venous systems of the nose to drain excess interstitial fluid.[7] Strict dissection along the superficial musculoaponeurotic system of the nose has been shown to create the least trauma and bleeding.[8] Furthermore, osteotomies have been

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major culprits in rhinoplasty morbidity because of angular vessel injury and nasal bone fractures.[9] The external perforating technique has been reported to create less trauma to the nasal region but, despite this, postoperative edema and ecchymosis can still occur.[10]

To date, numerous techniques have been offered to prevent and attenuate these suboptimal postoperative findings. Gun et al. reported that, although lidocaine and adrenaline reduced bleeding and pain (which may indirectly decrease edema and ecchymosis), no clinically significant direct correlation pertaining to reduction was found.[11]

Totonchi and Guyuron investigated the use of arnica and corticosteroids for reducing postoperative edema and bruising in rhinoplasty. *Arnica montana* is an herbal medication with antiinflammatory properties used for pain, soreness, and ecchymosis.[12] In this study, 48 rhinoplasty patients were given arnica, dexamethasone, or placebo. They concluded that arnica and corticosteroids may be useful for edema reduction in the early postoperative period (48 hours).[9]

Taskin et al. studied the efficacy of using cold saline-soaked gauze compression and intraoperative single-dose corticosteroids in rhinoplasty patients. Three hundred patients were given either dexamethasone with cold saline gauze compression or dexamethasone with dry gauze compression. Interestingly, although operative time was increased in the treatment arm, significant reduction in periorbital ecchymosis and eyelid edema was noted in the study group following postoperative days 1, 3, 5, and 7.[13] It was hypothesized that the cold administration creates local vasoconstriction, slows cell metabolism, and decreases the inflammatory cascade and muscle tone and spasticity. Kelly et al. described the practice among surgeons with lower operative volumes of using ice packs to prevent postoperative bruising.[14]

Xu et al. studied the efficacy of melilotus extract in the management of postoperative ecchymosis and edema after simultaneous rhinoplasty and blepharoplasty. Melilotus extract has a coumarin component and can decrease edema associated with trauma, burns, and lymphedema. Forty-six patients were studied in three groups receiving either melilotus extract, dexamethasone, or placebo. They noted that upper eyelid, lower eyelid, and paranasal edema at postoperative days 1 and 4 were significantly lower in the dexamethasone group compared with the control. The melilotus group experienced reduced paranasal edema at postoperative days 4 and 7 when compared with the control group.[15]

The common thread in these treatments for ecchymosis and edema after rhinoplasty is the use of corticosteroids. The first adrenal steroid synthesized was 11-desoxycorticosterone, described by Steiger and Reichstein in 1937.[16] Since then, corticosteroids have enjoyed a multitude of uses in modern day medicine. Their mechanism of action, although not completely elucidated, involves retardation of the inflammatory response. Corticosteroids interact with steroid and intracellular receptors that orchestrate gene transcription of enzymes and proteins that aid in inflammation and its sequelae. Corticosteroids inhibit leukocyte chemotaxis, enzymatic lipolysis and proteolysis, and arachidonic acid and cyclooxygenase production. In addition, corticosteroids down-regulate interleukin-6, tumor necrosis factor-α, endothelial leukocyte adhesion molecule-1, intracellular adhesion molecule-1, and basophilic release of histamine and leukotrienes. The synthetic glucocorticoid dexamethasone has a significantly more robust ability to inhibit the inflammatory cascade when compared with endogenous hydrocortisone and prednisolone. Its potency also can be attributed to its long half-life of 36 to 72 hours.[17,18] These properties render corticosteroid use as a viable and beneficial adjunct in preventing the inflammatory response in medicine and, in this case, edema and ecchymosis after elective rhinoplasty.

The purpose of this current work is to provide a review of the literature regarding corticosteroid use in cosmetic surgery patients. Because of the plethora of studies in the literature addressing steroid use associated with rhinoplasty, this will serve as the focus of the majority of this systematic review. Although sparse, studies addressing steroid use in rhytidectomy and body contouring can be found, but a systematic review of these procedures is nearly impossible and highly biased. Therefore, a review of the pertinent works regarding steroids and these other procedures is included for comprehensiveness. Thus, an adequate review will provide the plastic surgeon with a resource for making knowledgeable decisions regarding the care of these cosmetic patients, especially after rhinoplasty, and for the prevention and treatment of postoperative facial ecchymosis and edema.

PATIENTS AND METHODS

Data Sources

A literature search of the following electronic databases was conducted: MEDLINE, Cochrane

Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, and PubMed. The key words used included a combination of "steroids," "corticosteroids," "plastic surgery," "plastic," "cosmetic surgery," "cosmetic," "rhinoplasty," "nose," "rhytidectomy," "facelift," "face," "body contouring," "edema," "ecchymoses," "ecchymosis," and "bleeding." The search was limited to articles published in English between the years 1965 and 2012. Reference review from these works yielded two additional sources that were used between the years 1937 and 1952.

Selection Validation

To validate the selection process of articles for this systematic review, two researchers (B.P. and P.D.) independently selected the articles. Inclusion criteria consisted of human adults (18 years and older); case or group controlled trials of corticosteroid administration preoperatively, intraoperatively, and postoperatively; in adjunct with other interventions with either prospective or retrospectively collected data. Exclusion criteria consisted of the year range limit, uncontrolled case series, comments, editorials, letters, languages other than English, abstracts only, and nonhuman studies. Works that passed initial screening were read in their entirety and reexamined for inclusion versus exclusion. Selections were made without knowledge of one another's selections. A third reviewer was included if any further clarification over inclusion/exclusion was needed (R.J.R.).

Using the aforementioned key words, 489 initial studies were found using the databases. Of the selected titles, 15 abstracts were found to meet the inclusion criteria. These works were evaluated in their entirety, and the final number of studies included in this systematic review was 12. The final number was obtained after excluding two studies that were meta-analyses and one study that was a survey. Cohen's kappa for level of agreement between the two reviewers was 1.0.

Data Extraction

Data from each of the studies were entered into a standardized form including the following parameters: author, year, sample size, age, follow-up, statistical analyses, eyelid/edema assessment, significant findings, p values, and steroid regimens.

The minuscule number of works regarding steroids with rhytidectomy and body contouring precluded an exhaustive systematic review. Instead, a general review of the present literature was performed for completeness.

RESULTS

Results are presented in Tables 1 through 4.[2,9,17,19–35]

DISCUSSION

Corticosteroid Use in Rhinoplasty

Rhinoplasty is technically challenging and can be equally satisfying for the surgeon and the patient. However, postoperative facial edema and ecchymosis can taint a seemingly effective and uneventful surgery. Specifically, aside from patient and familial psychological distress, these postoperative findings may alter the contour and morphology of the final nasal appearance. A thorough chronologic review of the literature may assist the surgeon in decision-making and treatment for these patients.

Several experimental and clinical models were the prototypes for present day steroid use in rhinoplasty. Show and Parsons in 1977 treated patients with severe facial edema after chemical peels and dermabrasion with 1 g of intravenous methylprednisolone.[36] This algorithm was used by Habal and Powell in 1978 in an experimental porcine model. Piglets underwent coronal incisions to produce facial edema. Immediate postoperative intravenous infusion of 1 g of methylprednisolone revealed a statistically significant reduction in facial edema compared with control animals.[37] Yamada et al. reported decreased peritumoral brain edema in rats after methylprednisolone.[38] Schaberg et al. showed a 61 percent reduction in facial edema using methylprednisolone and computed tomography 24 hours after Le Fort I osteotomy.[39] Goldman et al. in 1952 reported the first use of steroids in rhinoplasty.[40] These initial clinical and experimental studies served as a foundation for the more precise clinical studies that provided more information on the treatment of postoperative rhinoplasty edema and ecchymosis.

Habal hypothesized that the action of steroids in facial edema pertained to a decrease of fluid at the capillary level and flow reduction at the venoarterial sphincters. He treated 158 patients, of whom 79 underwent rhinoplasty with 1 g of postoperative methylprednisolone. Patients were observed for 48 hours and then at 2 weeks. No statistical analysis was performed, but clinical observation revealed reduced facial edema and shorter courses when edema was evident.[22]

Table 1. Rhinoplasty Study Characteristics of Reviewed Sources

Reference	No.	Age (yr)	Follow-Up	Statistical Analyses
Berinstein et al., 1998[19]	20	18–45	48 hr	Factorial ANOVA
Griffies et al., 1989[2]	30	18–45	24 hr	One-sided *t* test
Gurlek et al., 2006[20]	40	22–30	Day 1, 3, and 7 and 6 mo	Kruskal-Wallis, Wilcoxon, ANOVA
Gurlek et al., 2009[21]	40	19–35	Day 1, 3, and 7	Kruskal-Wallis, Wilcoxon, ANOVA
Habal, 1985[22]	79	NR	Days 1–5	None performed
Hatef et al., 2011[23]	N/A*	N/A*	N/A*	N/A*
Hoffmann et al., 1991[24]	49	15–70	Days 1, 4, and 7	One-way ANOVA
Kara and Gökalan, 1999[25]	55	Mean, 23.7	24 hr–9 days	ANOVA, post hoc test
Kargi et al., 2003[26]	60	NR	24 hr; days 2, 5, 7, and 10	Kruskal-Wallis, Mann-Whitney *U* tests
Koc et al., 2011[27]	40	Mean, 27 ± 0.1	Day 1, 3, and 7	Pearson χ^2, Kolmogorov-Smirnov, ANOVA, Kruskal-Wallis ANOVA
Ofo et al., 2006[17]	N/A†	N/A†	N/A†	N/A†
Saedi et al., 2011[28]	74	Mean, 26.4 ± 5.0	Days 1, 7, and 30	χ^2, ANOVA
Totonchi and Guyuron, 2007[9]	48	15–65	Days 2 and 8	One-way ANOVA
Tuncel et al., 2013[29]	60	23–35	24 hr and days 2, 5, 7, and 10	Kolmogorov-Smirnov, ANOVA, Kruskal-Wallis ANOVA, Mann-Whitney, Friedman test, Wilcoxon rank sum
Youssef et al., 2013[30]	N/A*	N/A*	N/A*	N/A*

ANOVA, analysis of variance; N/A, not applicable.
*Meta-analysis.
†Survey study.

Griffies et al. showed a benefit to steroid use. They studied 30 patients who underwent rhinoplasties with osteotomies. They used a single 10-mg dose of preoperative dexamethasone in 16 patients and placebo in 14 patients. Using a four-point scale, a statistically significant reduction in periorbital edema and ecchymosis was noted.[2]

Hoffmann et al. noted significantly reduced postoperative eyelid and paranasal edema in patients receiving steroids. They studied 49 patients and administered both perioperative and postoperative steroids. They also noted a trend toward less ecchymosis, intranasal edema, and discomfort.[24]

Despite the theoretical and evidence-based benefits of steroid therapy in rhinoplasty, controversy with its use still exists. Berinstein et al. evaluated postoperative edema after a preoperative 10-mg dose of dexamethasone was given to 20 male rhinoplasty patients. This study was conducted at a military academic tertiary referral center, and all patients underwent rhinoplasty with osteotomies. Preoperative and postoperative magnetic resonance imaging was used to evaluate postoperative edema. Soft tissue over bone at the nasal bone–maxilla junction was measured in millimeters by two blinded neuroradiologists. Surprisingly, steroids increased swelling significantly from an average of 4.2 ± 3.22 mm without steroids to 5.5 ± 2.1 mm with dexamethasone (31 percent increase).[19] Ofo et al. also noted that a minority of surgeons in the United Kingdom used steroids to reduce postoperative edema and ecchymosis. They used a postal survey of consultant otolaryngologists in the United Kingdom. The survey had a response rate of 62 percent (203 surveys) and revealed that only 24 percent of consultants used steroids routinely to prevent swelling and bruising. They postulated that the unpopularity of steroids may be attributable to the weaknesses of the randomized controlled studies, lack of long-term benefits, and concerns regarding the side effects of steroids.[17]

Kara and Gökalan examined single-dose steroid use on edema, ecchymosis, and intraoperative bleeding in rhinoplasty. Fifty-five patients were grouped into 10 mg of dexamethasone either preoperatively or postoperatively or a placebo group. They noted that there was a statistically significant difference between the steroid groups and placebo only for a decrease in eyelid edema. Using a four-point scale, reduction of upper eyelid ecchymosis was statistically significant in the steroid groups compared with the placebo group. However, steroids had no effect on lower eyelid ecchymosis. Also, no differences were noted between the steroid groups with regard to edema or ecchymosis. They concluded that the effect of dexamethasone was lost after 2 days and it did not reduce the recovery period.[25]

Kargi et al. evaluated the effect of steroids on edema, ecchymosis, and intraoperative bleeding in rhinoplasty using a different steroid regimen. Sixty patients were divided into six groups: single dose of 8 mg of dexamethasone 1 hour preoperatively; 8 mg of dexamethasone at the start of surgery; three doses of 8 mg 1 hour preoperatively and 24 and 48 hours postoperatively; three doses of 8 mg at the start of surgery and 24 and

Table 2. Rhinoplasty Steroid Regimens for Reference Sources

Reference	Eyelid/Edema Assessment	Significant Findings	*p*
Berinstein et al., 1998[19]	Preoperative/postoperative MRI within 48 hr	Increased edema after steroids in rhinoplasty	<0.02
Griffies et al., 1989[2]	Four-point scale	Reduction in periorbital edema and ecchymosis	<0.05
Gurlek et al., 2006[20]	Digital photography scoring by three independent observers using four-point scale	No significant differences between the different steroids in preventing/reducing edema or ecchymosis after open rhinoplasty with osteotomies	<0.05
Gurlek et al., 2009[21]	Digital photography scoring by three independent observers using four-point scale	High-dose steroids significantly reduced ecchymosis and edema; lower C-reactive protein levels associated with the steroid group	<0.05
Habal, 1985[22]	Observation	Clinical observation of reduced extent and course of facial edema	NR
Hatef et al., 2011[23]	N/A	Perioperative steroid use decreases postoperative edema and ecchymosis with rhinoplasty; preoperative and extended administration is superior to postoperative and singular dosing	<0.05
Hoffmann et al., 1991[24]	Four-point scale; anterior rhinoscopic examination; palpation	Reduction in postoperative upper and lower eyelid/paranasal edema in patients receiving steroids for up to postoperative day 4	<0.05
Kara and Gökalan, 1999[25]	Four-point scale	Single-dose dexamethasone preoperatively or postoperatively significantly reduced upper/lower eyelid edema and ecchymosis only for 48 hr	<0.05
Kargi et al., 2003[26]	Four-point scale	Pre-osteotomy triple-dose steroids greatest reduction of postoperative edema/ecchymosis	<0.05
Koc et al., 2011[27]	Four-point scale	Statistically significant reductions in periorbital edema and ecchymosis; 1 mg/kg most efficacious dose	<0.05
Ofo et al., 2006[17]	NR	Minority of UK surgeons do not use steroids "despite evidence supporting"	NR
Saedi et al., 2011[28]	NR	Decongestant and steroids had significant short-term reduction of ecchymosis	NR
Totonchi and Guyuron, 2007[9]	Blinded panelist: scale 0–3 (edema); 0–5 (ecchymosis)	Steroids helped reduce edema in early postoperative period (48 hr) but increased duration of ecchymosis	<0.05
Tuncel et al., 2013[29]	Four-point scale	Intraoperative bleeding and operative time significantly shorter in steroid group; three-dose group with significant reduction in eyelid edema and periorbital ecchymosis	<0.001
Youssef et al., 2013[30]	NR	Steroids significantly decrease postoperative periorbital edema within first 3 days but little effect afterward	NR

NR, not reported.

48 hours postoperatively; three doses of 8 mg given immediately after surgery and at 24 and 48 hours postoperatively; and a control group. Using a four-point scale, they noted no significant differences in the groups with regard to bleeding. Edema and ecchymosis were significantly lower in patients receiving steroids before osteotomies for the first 2 days compared with controls. On postoperative day 5, edema and ecchymosis were significantly decreased in the triple-steroid groups compared with the other groups. They concluded that the ideal regimen was triple steroids before osteotomies.[26]

Gurlek et al. studied the effects of different corticosteroids on edema and ecchymosis in open rhinoplasty. They divided 40 patients into five groups receiving betamethasone, dexamethasone, methylprednisolone, tenoxicam, or placebo. They infused the medications just before anesthesia and postoperatively for 3 days. Using a four-point scale, no differences were noted between the different types of steroids and, furthermore, these doses did not achieve prevention or reduction in edema or ecchymosis after rhinoplasty with osteotomies.[20] Gurlek et al. in 2007 followed up on their 2006 study by evaluating high-dose corticosteroids in open rhinoplasty. Forty patients were divided into five groups: a single dose of 250 mg of methylprednisolone, a single dose of 500 mg of methylprednisolone, four 250-mg doses of methylprednisolone, four 500-mg doses of methylprednisolone, and placebo. Using a four-point scale, a clinically and statistically significant reduction in ecchymosis and edema was noted in the high-dose groups compared with the control group. Also, lower C-reactive protein levels were evident in the steroid group compared with the control group. They concluded that high doses of steroids should

Table 3. Significant Findings of Reviewed Sources after Rhinoplasty

Reference	Steroid Regimens
Berinstein et al., 1998[19]	10 mg IV dexamethasone 1 hr preoperatively
Griffies et al., 1989[2]	10 mg IV dexamethasone
Gurlek et al., 2006[20]	Five groups: betamethasone, dexamethasone, methylprednisolone, tenoxicam, and placebo; all given before anesthesia induction and for 3 days postoperatively
Gurlek et al., 2009[21]	Five groups: single 250-mg IV dose of methylprednisolone; single 500-mg IV dose; four 250-mg IV doses; four 500-mg IV doses; placebo
Habal, 1985[22]	1 g IV methylprednisolone immediate postoperatively
Hoffmann et al., 1991[24]	10 mg intraoperative IV dexamethasone; 50 mg oral prednisone on postoperative day 1 with taper to 10 mg/day until final dose on postoperative day 5 of 10 mg
Kara and Gökalan, 1999[25]	10 mg IV once either preoperatively or postoperatively
Kargi et al., 2003[26]	6 groups: single dose of 8 mg IV dexamethasone 1 hr preoperatively; single dose at beginning of operation; 3 doses of 8 mg IV dexamethasone 1 hr preoperatively and 24 and 48 hr postoperatively; 3 doses of 8 mg IV dexamethasone at beginning of operation and 24 and 48 hr postoperatively; 3 doses immediately postoperatively; no dexamethasone
Koc et al., 2011[27]	Three groups: preoperative single 1 mg/kg IV methylprednisolone; preoperative 3 mg/kg; control
Saedi et al., 2011[28]	Three groups: 8 mg IV dexamethasone preoperatively, 24 and 48 hr postoperatively; three pseudoephedrine tablets daily for 1 wk; three pseudoephedrine tablets for 2 wk
Totonchi and Guyuron, 2007[9]	10 mg IV dexamethasone intraoperatively, then 6-day oral methylprednisolone
Tuncel et al., 2013[29]	Four groups: single dose 10 mg/kg IV dexamethasone at beginning of operation; 2 doses of 10 mg/kg IV dexamethasone at beginning of operation and 24 hr after the operation; 10 mg/kg IV dexamethasone at beginning of operation, before osteotomy, and 24 hr postoperatively; control

IV, intravenous.

be used if steroid therapy is instituted postoperatively in rhinoplasty.[21]

Koc et al. studied the effectiveness of steroids for edema, ecchymosis, and intraoperative bleeding in rhinoplasty. Forty patients were divided into three groups: a single dose of 1 mg of methylprednisolone, a single dose of 3 mg of methylprednisolone, and a control group. They reported statistically significant reductions in periorbital edema and ecchymosis when compared with controls. However, these differences did not occur when there was intergroup steroid comparison. Also, no bleeding difference was found. The authors concluded that there is, in fact, no need for higher doses of steroid if the steroid dose is adjusted appropriately to body weight.[27]

Saedi et al. compared the effect of steroids and decongestants in reducing rhinoplasty edema. Seventy-four patients were divided into three groups: 8 mg of dexamethasone preoperatively; three 60-mg pseudoephedrine tablets for 1 week; and three 60-mg pseudoephedrine tablets for 2 weeks. They reported that decongestant and steroids resulted in significant short-term reduction of ecchymosis and edema of the eye and nasal tip and dorsum. They concluded that the pseudoephedrine regimen was effective in postoperative edema reduction.[28]

Table 4. Significant Findings, Study Characteristics, and Steroid Regimens of Studies Pertaining to Facial Plastic Surgery and Body Contouring

Reference	No. of Patients	Regimen	Significant Findings
Owsley et al., 1996[31]	30	Perioperative Solu-Medrol 500 mg; 6 day Medrol dose pack	No significant differences in facial swelling between steroid-treated patients and untreated patients after rhytidectomy
Rapaport et al., 1996[32]	50	6 mg betamethasone IM preoperatively	No significant differences in facial swelling between steroid treated groups and untreated groups after rhytidectomy
Munro et al., 1986[33]	36	Dexamethasone (0.5 mg/kg) preoperatively and for 48 hr postoperatively (0.25 mg/kg)	No statistically significant difference between patients treated with steroids after mandibular and/or maxillary osteotomies
Echavez and Mangat, 1994[34]	55	60 mg prednisone taper over 6 days	No significant differences were noted in mood, edema, or ecchymosis between the placebo and postoperative steroid-treated groups, after facial plastic surgery
Steely et al., 2004[35]	143	Ondansetron, promethazine, metoclopramide, and the addition of dexamethasone in selected cases	Demonstrated a decrease of postoperative nausea and vomiting incidence from 22% to 3% using a prophylactic regimen

Hatef et al. performed a systematic review to evaluate the use of perioperative steroids for minimizing edema and ecchymosis after rhinoplasty. A comprehensive literature search was performed, yielding an initial 29 citations. After implementing their exclusion criteria, they used four articles: Hoffmann et al., Kara and Gökalan, Kargi et al., and Gurlek et al. They found that perioperative steroid use significantly reduces postoperative edema and ecchymosis of the upper and lower eyelids at postoperative days 1 and 7. They found a benefit in preoperative steroid dosing in decreasing eyelid edema compared with postoperative administration and also that extended dosing is superior to singular dosing.[23]

Tuncel et al. studied the efficacy of dexamethasone with controlled hypotension on intraoperative bleeding, postoperative edema, and ecchymosis in rhinoplasty. Using a retrospective approach, the authors evaluated 60 patients that were randomized into four groups: a single dose of 10 mg of dexamethasone given at the beginning of the operation; two doses of 10 mg of dexamethasone given at the beginning of the operation; three doses of dexamethasone given at the beginning of the operation; and a control group. All patients also underwent controlled hypotension (65 to 75 mmHg systolic). They reported that intraoperative bleeding and operative time were significantly reduced in all steroid-treated groups compared with the control. Ultimately, the three-dose group had a statistically significant reduction in lower and upper eyelid edema and periorbital ecchymosis.[29]

Youssef et al. performed a meta-analysis on the role of steroids in reducing postoperative edema in rhinoplasty. After performing a MEDLINE search and, by implementing inclusion and exclusion criteria, four articles were used. Using RevMan 5.1 (Copenhagen, The Nordic Cochrane Centre, The Cochrane Collaboration), they concluded that perioperative steroid use significantly reduces postoperative eyelid edema on the first and third days but that the benefit dissipates after the third day.[30]

In summary, based on the current literature, there is no compelling reason to routinely use steroids in rhinoplasty, and several reasons render the literature inconclusive. The study comparisons are all marred by heterogeneity and a multitude of other variables that preclude a definitive driving reason to prescribe corticosteroids, including technique variation (e.g., the addition of osteotomies can result in more trauma and a greater "load" of inflammation than the steroids may be capable of preventing). The subjectivity of the scales used to grade edema and ecchymosis provides a nonscientific means of comparison. Even more standardized comparisons made with magnetic resonance imaging and digital photography still have bias but, even more importantly, are not used consistently throughout the literature. When looking at the benefit for steroid use, the majority of it is in the immediate postoperative period. It is understandable that reduction in edema and ecchymosis enables a patient to reacclimate to society in a more seamless manner, but at what cost? Are these transient benefits worth risking the well-described potential side effects of steroids? These side effects include potential suppression of the hypothalamic-pituitary axis, avascular necrosis, postoperative wound infection, remote possibility of malignancy, diabetes, hyperlipidemia, peptic ulcer disease, and allergic reaction.[41] Such a risk, regardless of how diminutive it is, should be assessed before the haphazard administration of steroids.

Corticosteroid Use in Facial Plastic Surgery

Although the body of literature describing steroid use with rhytidectomy is undersized, a thorough evaluation of the current literature can be beneficial for potential treatment options. The initial studies showing benefit to steroid use were for craniofacial trauma. Nordström and Nordström noted in 44 patients given methylprednisolone after punch hair grafting that the frequency of edema decreased from 88 percent to 61 percent ($p = 0.0013$).[42] Other beneficial reports of steroid use have been described in commentaries and letters. Hoefflin clinically observed that use of steroids resulted in decreased prolonged swelling and pain associated with deep plane face lifts.[43] In the letter "Faces, Hips and Steroids," Habal also addressed and lauded these potential benefits of steroids.[44]

Contrary to the advantages of steroid use in facial surgery, the majority of studies have shown a lackluster and sometimes even nonexistent benefit. Owsley et al. performed a prospective double-blind study of 30 consecutive face lifts. The treatment arm received a loading dose of 500 mg of methylprednisolone intravenously followed by Kenalog (Bristol-Myers Squibb Co., Princeton, N.J.) and a 6-day dose taper of oral methylprednisolone. Preoperative and postoperative swelling was evaluated using a four-point scale by three independent plastic surgeons. Ultimately, there were no significant differences in facial swelling between the steroid-treated and untreated

patients.[31] Rapaport et al. in 1995 noted a similar lack of statistically significant reduction in swelling after facioplasty. Betamethasone was given after facial aesthetic surgery in 50 patients in a randomized double-blind study.[32] Munro et al., through a randomized double-blind study in 1986, evaluated the efficacy of steroid use in 36 pediatric patients undergoing mandibular and/or maxillary osteotomies. They found no statistically significant reduction in facial swelling.[33] The use of steroids was deemed unnecessary in the work provided by Echavez and Mangat in 1994. In their double-blind, randomized, placebo-controlled study, 55 patients were noted to have, interestingly, no significant differences in mood, edema, or ecchymosis after receiving steroids following facial plastic surgery.[34]

In summary, steroid use in facial plastic surgery has not shown significant efficacy in preventing edema or ecchymosis postoperatively. This, in conjunction with the aforementioned risks of unwarranted steroid usage, categorizes it as an ineffective means of preventing a seemingly transient problem.

Corticosteroid Use in Body Contouring Surgery

Postoperative nausea and vomiting is a significant problem after plastic surgery. It remains enigmatic in cause and treatment. Some of its sequelae can be disastrous in plastic surgery (i.e., aspiration, death, hematoma, and wound breakdown). The chemotactic zone is a brainstem area that has been studied as a major contributor to the vomiting reflex. The mechanism of steroids in preventing postoperative nausea and vomiting is not fully understood but is thought to be related to the antiemetic effect noted by antagonizing 5-hydroxytryptamine type 3 receptors.[45] Steely et al. performed a prospective study whereby 143 plastic surgery patients were given a prophylactic regimen of ondansetron, promethazine, metoclopramide, and dexamethasone for prophylaxis against postoperative nausea and vomiting in plastic surgery patients. They noted a decrease from 22 percent to 3 percent in postoperative nausea and vomiting and recommended this inexpensive ($56.43) protocol for prevention of this potentially problematic phenomenon.[35]

In summary, the use of steroid therapy in plastic surgery for prevention of postoperative nausea and vomiting seems beneficial. However, because of the other medications involved in these regimens, it is difficult to attribute the preventative benefit to steroids alone. The medications used in the regimen are well described and used for their antiemetic properties, and steroids may simply have a placebo-type effect. Nonetheless, their use may be warranted in preventing some of the seriously debilitating consequences of postoperative nausea and vomiting.

CONCLUSIONS

Steroid use in plastic surgery is a controversial topic in that there is no true means of effectively comparing the studies to make a truly educated decision regarding their use. Despite this, based on the body of evidence available, steroid use is not recommended for rhinoplasty or rhytidectomy and may be somewhat beneficial in preventing postoperative nausea and vomiting in some patients. Further studies exploring, specifically, various cohorts using stringent outcome evaluation methods are needed to reach more conclusive results.

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