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Controlled hypotension induced during rhinoplasty and risk for postoperative hair loss

Abstract

There is evidence of the close association between controlled hypotension induced during rhinoplasty surgery to prevent bleeding and hair loss after surgery. We aimed to assess the effect of controlled hypotension on hair loss in patients undergoing rhinoplasty.

The current prospective cohort study was conducted on 170 patients scheduled for rhinoplasty that referred to Al-Zahra hospital in Isfahan, Iran in 2020. As the control group, a sex and age-matched group of women referred to the hospital for breast prostheses was selected. To determine the severity of hair loss after surgery, a score for determining the severity of hair loss called SALT was used and the patients were followed-up for six months.

In total, 85 patients undergoing rhinoplasty in a controlled hypotensive state and 85 patients scheduled for breast prosthesis as the control were included in our assessment. After one month of operation, the group undergoing rhinoplasty in the controlled hypotensive condition experienced a higher prevalence rate of hair loss as compared to the control group. However, after a 6-month follow-up, we showed no difference in the hair density in the vortex area between the case and control groups. According to multivariable logistic regression modeling, controlled hypotension remained the main determinant for postoperative hair loss (RR = 4.620, P = 0.014). Despite the beneficial effects of controlled hypotension during rhinoplasty on reducing the risk of bleeding, this condition may lead to temporary postoperative hair loss.

Keywords: *rhinoplasty, hair loss, hypotension, bleeding*

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Introduction

Rhinoplasty is still the most common surgical procedure in the world and bleeding during surgery has always been a common consequence of this procedure.[1] Applying the technique of inducing controlled hypotension during rhinoplasty not only increases the surgeon's field of vision during surgery but also reduces the amount of bleeding during surgery and therefore ultimately reduces the amount of edema and ecchymosis after surgery.[2-5] In induction of controlled hypotension during the procedure, various drugs are used to maintain systolic blood pressure in the range of 80 to 90 mmHg and reduce the mean blood pressure to 50 to 65 mmHg by reducing the average basal blood pressure by 30%.[6,7]

Hair loss after surgical procedures is a rare complication of general anesthesia that has a variety of pathogenesis. In some reports, the main cause of postoperative hair loss is ischemia in the scalp due to the pressure effect on the scalp.[8] In cases where the cause of hair loss is diagnosed immediately, this event will be reversible, but in case of delayed diagnosis, it may be permanent and irreversible.[9] This issue has been reported following a variety of surgical procedures such as cardiovascular surgery, gynecological surgery, cancer surgery as well as cosmetic surgery such as rhinoplasty.[10,11] Temporary or reversible hair loss means localized hair loss without scarring that is sometimes seen within 2 to 3 weeks after surgery.[12] In some reports, hypotension during surgery has been associated with postoperative hair loss, and hypotension also appears to stimulate hair loss through the process of inducing local ischemia on the scalp.[13] Hair loss has even been reported following the use of antihypertensive drugs such as beta-blockers and ACE inhibitors.[14] However, the evidence for hair loss following induction of controlled hypotension in cosmetic surgery such as rhinoplasty is still limited and needs further investigation. We aimed to assess the effect of controlled hypotension on hair loss in patients undergoing rhinoplasty in comparison with the control group.

MATERIALS AND METHODS

The current prospective cohort study was conducted on 170 patients scheduled for rhinoplasty that referred to Al-Zahra hospital in Isfahan, Iran in 2020. All participants were female, aged higher than 18 years, and candidates for rhinoplasty with cosmetic goal or repair of structural deviations of the nose. As the control group, a sex and age-matched group of women referred to the hospital for breast prostheses was selected. The exclusion criteria were previous history of hair loss treated by a dermatologist or the patient himself mentioning hair loss in his history (which exceeds the normal rate of 100 per month), taking anti-hypertensive and anti-hair loss drugs, history of pathological skin and hair diseases, history of acute infectious or inflammatory diseases, history of chronic liver or kidney disease, history of malignancy or history of corticosteroid use in the last month. The study protocol was ethically approved by the ethics committee at Isfahan University of Medical Sciences.

Preliminary patient information including demographic, clinical, and pharmacological records of patients was determined through interviews with them and recorded in the study checklist. For rhinoplasty surgery, all patients underwent the same protocol of anesthesia and surgery with induction of controlled hypotension as well as by a single surgeon. The second group was selected as a control group of patients referred for prosthetic breast surgery who had been matched with the first group in terms of age and anesthesia drugs and were not induced by controlled hypotension. During surgery in both groups, changes in vital signs including systolic and diastolic blood pressure, heart rate, respiration rate, and arterial blood saturation, as well as the volume of blood lost during surgery were recorded. Patients were also monitored in the postoperative days for bleeding, changes in vital signs, or the need for analgesia. Patients in both groups were re-visited one month and 6 months after surgery and examined for the occurrence and severity of hair loss. To determine the severity of hair loss after surgery, a score for determining the severity of hair loss called SALT was used. In the pointed scoring system, for each of the areas under hair loss, a percentage of the intensity of hair loss is considered and the sum of the percentages in different areas of the scalp is determined for the final score of the intensity of hair loss.[15]

For statistical analysis, the Chi-Square test (or Fisher's exact test if required) was used to compare categorical variables, and the t-test or non-parametric Mann-Whitney U test for comparing quantitative parameters. The difference in the rate of alopecia with the presence of baseline variables was tested by the multivariable logistic regression modeling. The significance between variables was described based on the cutoff point of 0.05 for the P value. The statistical software SPSS version 23.0 for windows (IBM, Armonk, New York) was used for the final analysis.

RESULTS

In total, 85 patients undergoing rhinoplasty in a controlled hypotensive state (all with a pressure range of 60 to 70 mmHg) and 85 patients scheduled for breast prosthesis (with a blood pressure of 100 to 110 mmHg in 45.9% and higher than 110 mmHg in 54.1%) as the control were included into our assessment. As summarized in Table 1, the two study subgroups were matched in age, operation time, and preoperative serum hemoglobin concentration. The time of operation was in the range of 1 to 2 hours in all subjects. None of the patients in both groups had an intraoperative hemorrhage.

With respect to hair condition, the hair density in the vortex area was not different in the case and control groups before the operation the density of 250 to 300 hairs per area was found in 70.6% and 57.6% and higher than 300 hairs per area in 8.2% and 11.8% respectively ($p = 0.210$). However, after one month of operation, the group undergoing rhinoplasty in the controlled hypotensive condition experienced a higher prevalence rate of hair loss as compared to the control group with a density of 150 to 200 hairs per area of 71.8% and 25.9%, the density of 250 to 300 hairs per area of 2.4% and 9.4% and density higher than 300 hairs per area of 0.0% and 4.7% respectively ($p < 0.001$). With this situation and in the 6-month follow-up, we showed no difference in the hair density in the vortex area between the case and control groups (Table 2). According to multivariable logistic regression modeling (Table 3), controlled hypotension remained the main determinant for postoperative hair loss (RR = 4.620, P = 0.014).

DISCUSSION

As an interesting observation in almost all societies, hair loss and baldness has been strongly associated with environmental factors Along with genetic tendencies. In this regard, the association between hair loss and underlying metabolic disturbances, lifestyle, anthropometric parameters, smoking, obesity, and nutritional habits has been mentioned in different studies.[16-18] Additionally, the close link between alopecia and cardiovascular disorders and related potential risk factors such as diabetes, hypertension, and metabolic syndrome have been also revealed.[19,20] It is thus assumed that a disturbance of blood pressure that occurs for any reason can be a predisposing factor for hair loss in patients. Due to some clinical observations of significant hair loss following rhinoplasty surgery, especially in cases with induced hypotension, we hypothesized that the occurrence of hypotension, even in the induced form to reduce the amount of bleeding during and after surgery will be a risk determinant for postoperative hair loss. As revealed in the present study and as compared to the controls, induced hypotension during surgery could lead to an increased likelihood of hair loss after surgery even after adjusting baseline parameters. In other words, hypotension induced during rhinoplasty might increase the risk of hair loss by 4.6 times. Of course, the hair loss was only observed one month after surgery which was reversible that did not observe in the six-month follow-up. Similar evidence in other studies has confirmed our findings. However, some also ruled out a causal link between changes in blood pressure and the incidence of hair loss after surgery. Some authors have claimed that constant pressure on the scalp exacerbated by hypoxemia or hypotension can induce postoperative permanent hair loss and in other words, impaired blood flow due to mechanical stress, especially in hypotensive conditions, can cause hair loss in patients.[21] In a case report, a 37-year-old woman who underwent five-hour orthognathic surgery with a hypotensive state developed an area of temporary hair loss to her vertex three weeks following surgery that resolved within six months.[22] It seems that any change in blood pressure (especially in pathological conditions) can induce significant

changes in hair follicles, and reduce hair growth rate. In our study, although hypotension was controlled, the presence of this condition along with the effect of pressure on the scalp during surgery could reduce tissue blood flow and weaken hair follicles, which has been completely reversible due to non-pathological changes in blood pressure and lack of other metabolic disorders. Given that our study is the first study on the effect of controlled hypotension on the risk of hair loss after rhinoplasty surgery, to confirm the present findings, it is highly recommended to repeat the study in a wider community.

CONCLUSION

It can be finally concluded that in spite of the beneficial effects of controlled hypotension during rhinoplasty on reducing the risk of bleeding, this condition may lead to postoperative hair loss. Although such complications can be temporary, from an aesthetic point of view, it is very important for the patient and may lead to her dissatisfaction.

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Ethics statement

None.

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Tables

Table 1. Baseline characteristics in the study population.

Characteristic	Rhinoplasty group	Control group	P value
Age subgroup			0.645
18 to 20 years	47 (55.3)	44 (51.8)	
20 to 30 years	38 (44.7)	41 (48.2)	
Operation time ranged from 1 to 2 hours	85 (100)	85 (100)	1.000
Blood pressure			<0.001
60 to 70 mmHg	85 (100)	0 (0.0)	
100 to 110 mmHg	0 (0.0)	39 (45.9)	
Higher than 100 mmHg	0 (0.0)	46 (54.1)	
Preoperative hemoglobin level			0.579
10 to 12 g/dl	23 (27.1)	25 (29.4)	
12 to 14 g/dl	61 (71.8)	60 (70.6)	
Higher than 14 g/dl	1 (1.2)	0 (0.0)	

Table 2. The hair density in the vortex area before and after surgery.

Characteristic	Rhinoplasty group	Control group	P value
Before surgery			0.210
150 to 200	1 (1.2)	0 (0.0)	
200 to 250	17 (20.0)	26 (30.6)	
250 to 300	60 (70.6)	49 (57.6)	
300 to 400	7 (8.2)	10 (11.8)	
One month after surgery			<0.001
50 to 100	2 (2.4)	0 (0.0)	
100 to 150	7 (8.2)	0 (0.0)	
150 to 200	61 (71.8)	22 (25.9)	
200 to 250	13 (15.3)	51 (25.9)	
250 to 300	2 (2.4)	8 (9.4)	
300 to 400	0 (0.0)	4 (4.7)	
Six months after surgery			0.201

150 to 200	1 (1.2)	0 (0.0)	
200 to 250	17 (20.0)	27 (31.8)	
250 to 300	59 (69.4)	48 (56.5)	
300 to 400	8 (9.4)	10 (11.8)	

Table 3. Multivariable logistic regression analysis to determine the value of controlled hypotension on postoperative alopecia.

Item	**Beta**	**SE**	**P value**	**OR**	**95%CI for OR**	
					Lower	Upper
Hypotension	6.136	2.505	0.014	4.620	3.404	6.227
Age	-0.534	0.391	0.172	0.586	0.273	1.261
Blood pressure	-0.741	0.532	0.163	0.477	0.168	1.351
Preoperative Hb	0.871	0.438	0.047	2.390	1.013	5.639