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Facelift Complications Related to Median and Peak Blood Pressure Evaluation

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Abstract

Background Hematoma remains the most challenging complication of facelifting and has been associated with male sex, hypertension, aspirin use, smoking, and high body mass index. Patients who underwent a facelift were studied to determine rates of hematoma and other complications and to identify predictive and protective factors, including meticulous analysis of perioperative blood pressure.

Methods Charts of patients who underwent a facelift from 2003 to 2011 at our institution were retrospectively reviewed. Demographic, clinical, and procedural data were collected. All postoperative complications were recorded. Data from continuous blood pressure monitoring in the operating and recovery rooms were obtained from a perioperative database and stratified by median and peak values. Logistic regression was used for data analysis.

Results Of the 229 patients included, the majority were female (88.2 %), mean age at presentation was 62 years, and 35.8 % had hypertension. Postoperative complications occurred in 60 patients (26.2 %). The most common complication was unfavorable scar (7.4 %), followed by hematoma (6.5 %). Male sex ($P = 0.02$), history of hypertension ($P = 0.04$), preoperative systolic blood pressure (SBP) greater than 160 mmHg ($P = 0.04$), and operating room peak SBP greater than 165 mmHg ($P = 0.04$) were predictive factors for hematoma. Recovery room peak SBP greater than 150 mmHg ($P = 0.09$) was also associated with hematoma. On multivariate analysis, only male sex and preoperative SBP greater than 160 mmHg remained independent risk factors for hematoma.

Conclusions This study is unique in that it compares the rate of hematoma to continuous blood pressure data in the operating and recovery rooms stratified by median and peak values. Meticulous control of perioperative SBP is recommended for a safe facelift. History of hypertension, increased SBP at admission, and increased perioperative peak SBP are predictors for postoperative hematoma.

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Keywords Blood pressure · Perioperative · Complication · Facelift · Hematoma

Introduction

In 2012, approximately 120,000 facelifts were performed in the United States, the majority in females (90.4 %) and patients older than 50 years (84.4 %). The facelift was the seventh most common cosmetic surgical procedure in the US in 2012. Since 1997, when approximately 100,000 procedures were performed, the number of facelifts has increased 20 % according to the American Society of Aesthetic Plastic Surgery National Data Bank [2]. Several

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publications from prestigious authors and institutions in the past 50 years have helped decipher this challenging procedure. Postoperative complications are well established, and many prophylactic measures have been attempted, including drains, fibrin glue, tumescence solution, anticoagulant cessation, smoking cessation, different surgical techniques, and blood pressure control. Hematoma remains the most common complication of facelifting and can lead to skin necrosis, persistent facial edema, skin hyperpigmentation, increased rate of infection, neurapraxia, and prolonged recovery [1, 5, 6, 9–11, 13, 17, 19–21]. In previous series, facelift hematomas have been associated with male sex, preoperative blood pressure, postoperative reactive hypertension, use of aspirin, smoking, anterior platysmaplasty, superficial muscular aponeurotic system (SMAS) plication, and high body mass index (BMI) (>25) [1, 3, 4, 9–11, 13, 15, 16, 20].

The goal of this study was to analyze the facelift population in our institution, determine the rate of hematoma and other complications, and identify predictive and protective factors. Continuous perioperative blood pressure was thoroughly and meticulously analyzed using highly granular data from the Mayo Clinic Perioperative Data Mart [12]. We decided to stratify the blood pressure in peak and median values and analyze them separately. We believe the dynamic behavior of the perioperative systolic blood pressure (SBP) has a higher impact on postoperative hematoma rate than the median value. Logistic regression was used to analyze the data; univariate and multivariate models were used to calculate the contribution of one or more variables simultaneously and determine their true significance and independent association with complications.

Methods

This study was approved by our Institutional Review Board. The charts of patients who underwent a facelift at our institution from January 2003 to December 2011 were retrospectively reviewed. Facelift associated with reconstructive procedures ($n = 10$) and cosmetic facelifts using the subperiosteal plane ($n = 42$) were excluded from our series. A total of 229 patients were included in the study. Demographic and clinical data included age, sex, BMI, smoking history, comorbidities, and use of anticoagulants. Hospital stay and follow-up data were recorded. Procedural data included whether a facelift was primary or secondary, plane of dissection, use of SMAS plication, combined procedures, operative time, duration in recovery room, blood pressure continuous measurement, use of intraoperative antihypertensive medication, use of tumescence solution, use of fibrin glue, and placement of drains.

All postoperative complications were recorded, including hematoma, seroma, deep vein thrombosis, skin loss or slough, wound infection, motor deficit, sensation deficit, and unfavorable scar. A very low threshold was used to report complications. Hematoma was defined as a collection of blood underneath the facelift flap, regardless of its size, requiring close observation or additional intervention. Seroma was defined as a collection of serous fluid underneath the skin flap. Motor and sensation deficits were diagnosed on postoperative visits on the basis of the history and physical examination. Unfavorable scar was defined as hypertrophic by the surgeon or not aesthetically pleasing by the patient. As a general recommendation in our institution, all patients stopped the use of aspirin at least 10 days preoperatively, and perioperative prophylaxis for deep vein thrombosis consisted only of sequential compression devices with or without thromboembolism-deterrent compression stockings. Perioperative prophylactic antibiotics were given to all patients in this study.

Preoperative blood pressure was obtained at admission for the surgical procedure. Blood pressure was monitored continuously from the time of surgical incision to closure and in the recovery room (postanesthesia care unit). These data were obtained from a Microsoft Structured Query Language (Microsoft Corp., Redmond, WA) relational data warehouse, which contains perioperative data of all patients who have undergone procedures at our institution [12]. Group statistics were presented as n (%) for categorical variables and mean (SD) for continuous variables. Blood pressure cutoff points used for analysis were the optimal values obtained from the receiver operating characteristic (ROC) curve. The association of postoperative complications and variables was investigated with the χ^2 test and Fisher's exact test. The association between complications and outcome was determined with univariate and multivariate logistic regression. Risk factors for multivariate logistic regression were chosen from risk factors that were associated with outcome at a significance level of $P = 0.1$ or less on the univariate model. Statistical analysis was performed with JMP version 9 software (SAS Institute, Inc., Cary, NC).

Results

Demographics

Of the 229 patients included in the study, the majority (202, 88.2 %) were female, and the mean age at presentation was 62 years (SD = 7.5). Average BMI was 25 kg/m^2 (SD = 4.3), and only 6 patients (2.6 %) were active smokers. The most common comorbidity was hypertension (82 patients, 35.8 %), followed by diabetes (12, 5.2 %).

Sixty-eight patients (29.7 %) were taking aspirin, one was taking warfarin, and one was taking clopidogrel. Patients taking aspirin were instructed to stop using the medication at least 10 days before surgery. Patients taking other anticoagulants such as warfarin and clopidogrel were being closely followed in our thrombophilia clinic.

Operative Data

From 2003 to 2011, a total of 229 cosmetic bilateral facelift procedures were performed at our institution by 14 surgeons. Mean hospital stay was 1.4 days and mean duration of follow-up was 12.3 months. To avoid an artificial reduction in our complication rate, we excluded subperiosteal facelifts from this series given their decreased amount of dissection and risk of hematoma compared with subcutaneous and sub-SMAS facelifts. A subcutaneous facelift was performed in most of our patients (143, 62.4 %). Facelift raising a SMAS flap was performed in 86 patients (37.6 %). SMAS plication during subcutaneous facelifts was done in 91 patients (39.7 %). Only 46 patients (20.1 %) underwent a facelift only; 73 patients (31.9 %) had one combined cosmetic procedure, and 110 patients (48 %) had two or more combined cosmetic procedures. Almost a fourth (54, 23.6 %) of our patients had a secondary facelift.

Mean operative time was 6.3 h (SD = 2). The vast majority of patients (225, 98.2 %) underwent general anesthesia; the combination of intravenous sedation and local anesthesia was used in only 4 patients. All patients were transferred to a monitored recovery room (postanesthesia care unit) after the procedure, and the mean duration of stay was 1.9 h (SD = 1.3). Tumescence solution was used in most patients (171, 74.7 %) according to surgeon preference, as were topical fibrin glue (62, 27.1 %) and surgical drains (152, 66.4 %). Intraoperative or perioperative antihypertensive medications, either a β-adrenergic blocker or an α_2-adrenergic agonist, were used in 25 patients (10.9 %) according to the anesthesiologist's discretion. Retrospective data analysis showed no objective selection criteria for the use of intraoperative or perioperative antihypertensive medications, but there was a trend to use them in patients with a medical history of hypertension. Blood pressure values recorded before, during, and after the procedure were retrieved and analyzed (Table 1). Median and peak blood pressure values were evaluated separately.

Table 1 Perioperative blood pressure values in 229 patients who had facelifts

Systolic blood pressure (mmHg)	Mean (SD)
Preoperative	126 (18.7)
Operating room	
Peak	174.2 (24.8)
Median	102.1 (7.5)
Recovery room	
Peak	148.1 (17.6)
Median	136.5 (15.5)

Complications and Risk Factors

Postoperative complications occurred in 60 patients (26.2 %). The most common complication was unfavorable scar, which occurred in 17 patients (7.4 %); 5 of these 17 patients required a scar revision in the operating room. The scars were hypertrophic scars observed by the surgeon or were unsatisfactory to the patients. Hematoma occurred in 15 patients (6.5 %). Of these 15 patients, 7 underwent surgical drainage, 5 had aspiration at the office, and 3 were closely observed. No hematoma was observed in our small group of 4 patients who had intravenous sedation and local anesthesia. Sensation deficit occurred in 11 patients (4.8 %) and motor deficit in 9 (3.9 %). All the neurologic complications were temporary and completely resolved spontaneously during follow-up. Wound infection occurred in 9 patients (3.9 %), and one required operative reintervention for drainage of a small abscess. Seroma occurred in 4 patients (1.7 %), and two of them required drainage. Skin loss or slough adjacent to the suture line was present in 2 patients (0.9 %) and was treated conservatively. No episode of deep vein thrombosis was reported. The rate of facelift revision from 2003 to 2011 was 4.4 % (10 patients). Complication rates were comparable and there was no statistically significant difference among the 14 surgeons.

Although our focus was on postoperative hematoma (discussed separately below), we subjected each complication independently to statistical analysis and logistic regression to establish variables associated as a possible risk or protective factor. SMAS plication was found to be a risk factor for seroma formation (4.4 vs 0 %, $P = 0.006$). Smoking was found to be a risk factor for skin loss (16.7 vs. 0.45 %, $P = 0.03$). Use of tumescence solution was a protective factor for wound infection (2.3 vs. 8.6 %, $P = 0.04$). Use of intraoperative antihypertensive medications was a protective factor for an unfavorable scar (0 vs. 8.3 %, $P = 0.04$). All other variables, including operative surgeon, were independently analyzed for each complication and no statistically significant association was found.

Hematoma Risk Factors

Risk factors for hematoma were analyzed with univariate and multivariate logistic models (Table 2). Blood pressure

Table 2 Analysis of risk factors for hematoma in 229 patients who had facelifts

Variable	No. patients	Hematoma [*n* (%)]	Univariate *P* value	Multivariate *P* value (univariate $P < 0.1$)
Age (years)				
<55	31	1 (3.2)	0.38	
≥55	198	14 (7.1)		
Sex				
Male	27	5 (18.5)	0.02	0.009
Female	202	10 (4.9)		
BMI >30				
No	205	11 (5.4)	0.07	0.34
Yes	24	4 (16.7)		
Smoking				
No	223	15 (6.7)	0.36	
Yes	6	0 (0)		
Diabetes				
No	217	14 (6.4)	0.80	
Yes	12	1 (8.3)		
Hypertension				
No	147	6 (4.1)	0.04	0.27
Yes	82	9 (11)		
Depression				
No	182	13 (7.1)	0.45	
Yes	47	2 (4.3)		
Aspirin				
No	161	11 (6.8)	0.79	
Yes	68	4 (5.9)		
OR duration >6 h				
No	108	7 (6.5)	0.97	
Yes	121	8 (6.6)		
Plane of dissection				
Subcutaneous	143	9 (6.3)	0.84	
SMAS	86	6 (7.0)		
SMAS plication				
No	138	11 (8.0)	0.27	
Yes	91	4 (4.4)		
Secondary facelift				
No	175	12 (6.8)	0.73	
Yes	54	3 (5.6)		
Use of tumescence solution				
No	58	2 (3.4)	0.24	
Yes	171	13 (7.6)		
Fibrin glue				
No	167	10 (6)	0.58	
Yes	62	5 (8.1)		
Drain				
No	77	7 (9.1)	0.28	
Yes	152	8 (5.3)		
OR antihypertensive use				
No	204	11 (5.4)	0.08	0.052

Table 2 continued

Variable	No. patients	Hematoma [*n* (%)]	Univariate *P* value	Multivariate *P* value (univariate $P < 0.1$)
Yes	25	4 (16)		
Preoperative SBP >160 mmHg				
No	216	12 (5.6)	0.04	0.02
Yes	13	3 (23.1)		
OR SBP (peak) >165 mmHg				
No	81	2 (2.5)	0.04	0.36
Yes	148	13 (8.8)		
OR SBP (median) >100 mmHg				
No	89	5 (5.6)	0.65	
Yes	140	10 (7.1)		
Recovery room SBP (peak) >150 mmHg				
No	124	5 (4)	0.09	0.99
Yes	105	10 (9.5)		
Recovery room SBP (median) >140 mmHg				
No	137	7 (5.1)	0.29	
Yes	92	8 (8.7)		
Additional procedures				
No	46	1 (2.2)	0.13	
Yes	183	14 (7.6)		

BMI body mass index, *OR* operating room, *SBP* systolic blood pressure, *SMAS* superficial muscular aponeurotic system

cutoff points were the optimal values obtained from the ROC curve on JMP. Male sex, history of hypertension, preoperative systolic blood pressure (SBP) greater than 160 mmHg, and peak operating room SBP greater than 165 mmHg were all associated with a statistically significant increased rate of hematoma. A BMI >30, use of antihypertensive medication in the operating room, and a recovery room peak SBP greater than 150 mmHg were marginally statistically significant variables associated with hematoma. On multivariate analysis, including all variables with a $P < 0.1$ on univariate analysis, only male sex and preoperative SBP greater than 160 mmHg remained independent risk factors for hematoma.

Discussion

Our overall complication rate of 26.2 % is compatible with that in previous reports and reflects our low threshold to include even the minutest problem [6]. Our operative time was increased compared with that in other studies, likely due to the presence of residents in the operating room and a large number of additional cosmetic procedures in our series (80 %) [1]. Unfavorable scar was the most common complication: 17 patients (7.4 %) had a hypertrophic scar or were dissatisfied with the surgical incision. Scar revision was done in five patients. Use of antihypertensive agents (β-blocker or α_2-adrenergic agonist) in the operating room was a protective factor against unfavorable scars; we are unable to explain this finding. Seroma occurred in 4 patients (1.7 %) and was associated with SMAS plication performed in subcutaneous facelifts. Skin loss or slough adjacent to the suture line occurred in only 2 patients (0.9 %) and was associated with smoking, as is known from previous data in the literature [22]. No deep vein thrombosis was reported; perioperative sequential compression devices with or without thromboembolism-deterrent compression stockings were used in all patients, but none received pharmacologic prophylaxis. Wound infection developed in 9 patients (3.9 %); one required operative drainage of an abscess. All patients received perioperative prophylactic antibiotics. The use of tumescence solution, previously shown to reduce the rate of skin necrosis, hypertrophic scar, alopecia, facial edema, and bruising [14], decreased the rate of wound infection in our patients (2.3 vs. 8.6 %, $P = 0.04$). Neurologic complications were all temporary. Nine patients (3.9 %) with motor deficit and 11 patients (4.8 %) with sensation deficit all had spontaneous resolution with conservative measures during close follow-up.

Our rate of hematoma was 6.5 % (15 patients). This rate is similar to that in previous reports (range = 1.9–15.6 %)

[1, 3, 4, 6, 10, 11, 13, 15–17, 19–21]. Importantly, the definition of hematoma varied among these series. We were very critical and included all collections of blood underneath the facelift flap regardless of size. Of our 15 patients with hematoma, 7 underwent surgical drainage, 5 had aspiration at the office, and 3 were closely observed. The association between blood pressure and hematoma in facelift procedures had been well established and validated by several studies and is not new to the plastic surgery community [7–11, 18, 21].

Unlike previous studies, our series provides a thorough and meticulous analysis of continuous monitoring of blood pressure in the operating room and in the recovery room. Taking advantage of the sophisticated Mayo Clinic Perioperative Data Mart, median and peak SBP values were analyzed separately for the first time in the facelift literature. Diastolic blood pressure has been shown to have no effect on the occurrence of hematoma after facelifts and was not analyzed in our study [10]. We noticed a closer association of hematoma with peak blood pressure rather than with median blood pressure in both the operating and the recovery room. Mechanisms of bleeding related to increased peak SBP could be due to dislodgment of blood clots from distal ends of transected vessels or to increased hydrostatic pressure on imperceptible spastic (not tied, not electrocoagulated) small vessel stumps. A statistically significant increased number of hematomas occurred when operating room peak SBP was greater than 165 mmHg (8.8 vs. 2.5 %, $P = 0.04$). A marginally statistically significant increased number of hematomas occurred when recovery room peak SBP was greater than 150 mmHg (9.5 vs. 4.0 %, $P = 0.09$). A history of hypertension and preoperative SBP greater than 160 mmHg were both associated with an increased rate of hematoma. Male sex was another independent risk factor of hematoma, as in other studies [3, 10, 11, 16]. The facial skin in males is thought to be more vascular because of beard hair follicles and sebaceous glands. BMI >30 was associated with an increased incidence of hematoma, but it was not a statistically significant factor. Age, smoking, diabetes, depression, use of aspirin, plane of facelift dissection, SMAS plication, secondary facelift, use of tumescence solution, fibrin glue, drain, and additional cosmetic procedures were not associated with hematoma formation in our series.

Numerous publications have documented the importance of blood pressure control during a facelift and its association with hematoma rate. Our data reinforce the need for rigorous and continuous blood pressure control in the operating and recovery rooms, where peak SBP and not median SBP values are associated with an increased rate of hematoma. Surgeons and anesthesiologists need to work as a team to attain adequate perioperative arterial blood pressure values, using antihypertensive medications when indicated and providing optimal pain and nausea control. Operating with "hypotensive" anesthesia could be in vain if blood pressure increases significantly in the recovery room, where there is no opportunity for surgical hemostasis. In patients with increased blood pressure at admission, postponing the procedure until blood pressure is adequately controlled should be considered to avoid a known increased risk for hematoma.

We acknowledge that our results reflect the characteristics of our institution. For instance, a single-surgeon experience in a busy aesthetic surgery center with a dedicated anesthesia team will culminate in less procedural variables and possibly different results and conclusions.

Conclusion

This study is unique in that it compares the rate of hematoma to continuous blood pressure data in the operating and recovery rooms stratified by median and peak values. Meticulous control of perioperative SBP is recommended for a safe facelift. History of hypertension, increased SBP at admission, and increased perioperative peak SBP are predictors for postoperative hematoma. Plastic surgeons and anesthesiologists should be aware of these risk factors.

Conflicts of interest The authors have no conflicts of interest or financial ties to disclose.

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