

Aspirin Therapy, Multimorbidity, and Microvascular Instability as Predictors of Hematoma after Facial and Body Plastic Surgery

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Abstract

Introduction: The rising demand for cosmetic and plastic surgery in urban Kyrgyzstan has increased concerns about post-operative complications, including venous thromboembolism, which is increasingly understood as an inflammation–coagulation “immunothrombotic” process involving endothelial dysfunction and platelet–leukocyte interactions. **Objective:** This retrospective study assessed the frequency and predictors of complications after facial and body plastic, esthetic, and reconstructive procedures in Bishkek, Kyrgyz Republic. **Materials and methods:** Pre-operative assessment included history, examination, complete blood count, coagulation profile, biochemistry, and electrocardiogram; smokers were advised to abstain for 3 weeks, and patients on antiplatelet therapy stopped aspirin 7–10 days pre-operatively. **Results:** Among 370 patients (mean age 55.9 ± 6.81 years; 85.1% women; mean body mass index (BMI) 23.1 ± 3.72 ; 19.7% smokers; 11.1% aspirin users; 29.7% with multiple comorbidities), 69.7% underwent body procedures and 30.3% facial procedures, with a mean operative duration of 3.7 ± 1.8 – 4.2 ± 1.3 h. The overall complication rate was 17.0% (63/370), with hematoma (52.4%), anemia (20.6%), chemosis (17.5%), and minor eye infections (7.9%) being the most common; no sepsis or pulmonary embolism occurred, although a fatal case was reported nationally. Univariate analysis revealed that age ≥ 55 years, BMI >25 , aspirin use, and >2 comorbidities were associated with complications. Multivariable modeling identified prior aspirin use (adjusted odds ratio [OR] 4.8; $P = 0.01$) and multimorbidity (adjusted OR 5.2; $P = 0.01$) as independent predictors. Hematoma risk was higher with aspirin exposure (adjusted OR 5.3; $P = 0.001$) and multimorbidity (adjusted OR 2.49; $P = 0.001$), supporting 1-month pre-operative aspirin cessation and risk stratification. Post-operative complications were noted in 17% of patients undergoing plastic, esthetic, and reconstructive surgery, with hematoma being the most common issue. **Conclusion:** Post-operative complications were noted in 17% of patients undergoing plastic, esthetic, and reconstructive surgery, with hematoma being the most common issue.

Key words: Cosmetic procedures, inflammation, plastic surgery, post-operative complications, venous thromboembolism

INTRODUCTION

The growing popularity of cosmetic and plastic surgery in urban Kyrgyzstan, aimed at rejuvenation or enhancing attractiveness, has influenced cosmetologists, dermatologists, general practitioners, plastic surgeons, and dental professionals. The practice of altering one's appearance has existed for centuries. Individuals of all ages aspire to

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appear youthful and attractive. Today, there is an increasing focus on appearance and beauty in society. In countries, such as the United States, beauty is defined by the media through magazines, television, and social media. An ideal image depicts someone with a perfect career, family, social status, and flawless appearance.^[1] More individuals worldwide are turning to cosmetic procedures to achieve this look.

The International Society of Aesthetic Plastic Surgery reported an 11.6% increase in non-surgical procedures and a 5.1% increase in all cosmetic procedures in 2018.^[2] In 2006, the United States saw approximately 11.7 million cosmetic surgeries and non-surgical procedures.^[3] By 2014, 15.6 million cosmetic procedures were performed, marking a 3% increase from 2013, totaling \$12.9 billion.^[4] In 2019, the United States recorded 18.1 million cosmetic surgeries and 16.1 million minimally invasive procedures performed.^[5]

Complications after plastic and esthetic surgeries remain a significant clinical issue. Surgeons face challenges with post-operative complications, such as hematoma, anemia, infection, and venous thromboembolism (VTE), especially in patients with health conditions or during long surgeries. Recent systematic reviews suggest that thromboembolic events in esthetic and reconstructive surgeries are still a notable concern, emphasizing the need for thorough risk assessment and preventive measures.^[6] VTE is a complex immune-driven process involving platelet activation, endothelial damage, and cytokine signaling.^[7]

Surgical tissue damage and ischemia-reperfusion reveal damage-associated molecular patterns and activate pattern recognition receptors on endothelial cells, platelets, and leukocytes, initiating inflammation for hemostasis and wound management. Pro-inflammatory mediators induce tissue factor expression in endothelial cells and monocytes, initiating extrinsic coagulation and thrombin production. Simultaneously, anticoagulant and fibrinolytic defenses diminish, creating a feedback loop between inflammation and coagulation that worsens the injury.^[8,9] Neutrophils and activated platelets form heterotypic aggregates and release extracellular chromatin and proteins, enhancing platelet adhesion and thrombus formation. Activated monocytes and endothelium express procoagulant molecules, causing microvascular blockage.^[8,10]

Microvascular thrombosis and endothelial damage lead to organ dysfunction, including acute kidney injury, lung dysfunction, and myocardial injury. These arise from immunothrombotic processes driven by tissue factors, thrombin, and neutrophil-platelet interactions.^[9,10] Neutrophil extracellular trap (NET) and platelet-rich thrombi form in inflamed veins, causing deep vein thrombosis (DVT) and pulmonary embolism. Inflammation-induced coagulation shifts perioperative hemostasis toward thrombosis.^[8,10]

Preoperative assessment of the inflammatory burden can identify high-risk patients.^[11] Interventions should focus

on limiting excessive innate activation, maintaining host defense, and promoting endothelial homeostasis. Therapeutic decisions must be personalized because network components are interconnected.^[9,12]

Antiplatelet therapy, particularly low-dose aspirin, influences immune responses and healing by disrupting platelet activation and platelet-driven inflammation, which connects hemostasis to innate immunity. This occurs by inhibiting platelet cyclooxygenase-1, which decreases thromboxane A2 and reduces platelet degranulation, surface P-selectin expression, microparticle release, and platelet-leukocyte aggregate formation. These aggregates recruit neutrophils and monocytes, encourage NET formation, and promote tissue factor-dependent thrombin generation in damaged tissues, a concept called immunohemostasis.^[12] In addition, aspirin can alter lipid mediator profiles toward pro-resolution pathways (aspirin-triggered specialized pro-resolving mediators), which enhance macrophage efferocytosis and transition to reparative states, facilitating matrix deposition and angiogenesis during wound healing.

In Kyrgyzstan, where regional data on post-operative complications of cosmetic surgery are lacking, these processes remain poorly understood. This study examined complications in patients at a private medical facility, given the growing popularity of plastic surgeries. This study aimed to assess the frequency of complications, identify risk factors, and address the risks of venous pulmonary thromboembolism.

MATERIALS AND METHODS

This retrospective observational study was conducted at two private healthcare centers in Bishkek, Kyrgyz Republic: Nova Clinic and the Clinic of Dr. Meerim Davletova. This study examined the medical records of all patients who underwent plastic, aesthetic, or reconstructive surgery between January 2022 and December 2024. The institutional bioethics committee of I.K. Akhunbaev Kyrgyz State Medical Academy approved this study (Protocol No. 7, dated May 20, 2022). All participants provided written informed consent for inclusion and for the use of anonymized data in the study.

A total of 370 patients participated in the study. The inclusion criteria were adults aged 18 years or older who underwent planned facial or body plastic surgery during the study period, completed a pre-operative assessment, and attended follow-up appointments. Patients with incomplete documentation or those who underwent emergency surgeries were excluded.

Demographic data included age, gender, and body mass index (BMI). The clinical data comprised smoking history, health conditions, medication usage (such as antiplatelet therapy), and the number of concurrent diseases. The assessed comorbidities included hypertension, coronary

artery disease, diabetes, respiratory conditions, genitourinary issues, and thyroid or rheumatologic disorders.

The surgical dataset included facial cosmetic surgeries (rhinoplasty, blepharoplasty, and facelift) and body contouring surgeries (liposuction, abdominoplasty, and mammoplasty). Each patient underwent a pre-operative assessment, which included a review of their medical history, physical examination, complete blood count, coagulation profile, serum biochemistry, and electrocardiogram. Patients on aspirin or antiplatelet medications were advised to stop taking them 7–10 days before surgery, and smokers were recommended to refrain from smoking for 3 weeks before the procedure.

After surgery, the patients were observed for 24–48 h before discharge and followed up for 30 days. Complications were identified as adverse events occurring after surgery that were directly linked to the procedure and required medical intervention, observation, or readmission. The documented complications included hematoma, anemia, chemosis, infection, and VTE.

The main focus was on complications following the surgery. The secondary objective was to identify the risk factors for these complications, emphasizing hematomas and thromboembolic events.

Data analysis was performed using the Statistical Package for the Social Sciences version 22.0 (IBM Corp., Armonk, NY, USA). Continuous variables are presented as mean $\pm$ standard deviation, and categorical variables are presented as frequencies (*n*) and percentages (%). The Student's *t*-test was applied to continuous data, and the χ^2 test or Fisher's exact test for categorical comparisons. Logistic regression analysis identified independent predictors of post-operative complications after adjusting for age, BMI, aspirin use, surgery duration, and multiple health conditions. A two-tailed *P* < 0.05 was deemed significant.

RESULTS

In this study, demographic characteristics of 370 patients showed an average age of 55.9 ± 6.81 years, with 53.2% (197 individuals) aged ≥ 55 years. Women comprised 85.1% of the participants, and men comprised 14.9% of the participants. The average BMI was 23.1 ± 3.72 , with 65.1% having a BMI of over 25. Among the patients, 110 (29.7%) had multiple comorbidities. Hypertension was the most common, affecting 62 of 110 patients, followed by mild anemia (39 of 110), thyroid disorders (21 of 110), and diabetes mellitus (19 of 110). Regarding polymorbidity, 27 patients (7.3%) had two diseases, and 49 patients (13.2%) had more than two diseases.

Among the patients, 73 (19.7%) were identified as active smokers. A total of 41 patients (11.1%) used antiplatelet

medications in the form of aspirin. According to internal guidelines, these patients were instructed to discontinue aspirin use a week before surgery and to cease smoking 3 weeks before the procedure [Table 1].

Most patients (258, 69.7%) underwent surgeries related to plastic, esthetic, and reconstructive body procedures. Among these, liposuction was the most frequently performed procedure, involving 102 patients (62.0%). This was followed by abdominoplasty, which was performed in 91 patients (28.3%), and mammoplasty, which was performed in 65 patients (28.3%).

The other 112 patients (30.3%) underwent plastic esthetic surgery on their faces. These included rhinoplasty in 57 patients (50.9%), blepharoplasty in 40 individuals (35.7%), and facelift in 15 individuals (13.4%). On average, the surgeries lasted 3.7 ± 1.8 h. In 121 (32.7%) cases, the procedures exceeded 4 h, and in 19 (5.1%) cases, they lasted more than 6 h.

The overall complication rate was 17.0%, affecting 63 patients, with 51 women (16.1%) and 12 men (21.8%) experiencing complications. Hematoma was the most prevalent post-operative issue, occurring in 33 patients (52.4%), followed by anemia in 13 patients (20.6%), chemosis in 11 patients (17.5%), eye infections in 5 patients (7.9%), and one case of eyelid ectropion (1.6%).

Notably, there were no instances of pulmonary embolism in our patients. However, a fatal case of pulmonary embolism was reported at another private clinic in the country.

Table 1: Clinical, demographic and operation characteristics of patients

Characteristics	<i>n</i> (%) / <i>M</i> $\pm$ <i>m</i>
Female	315 (85.1)
Male	55 (14.9)
Age	55.9 ± 6.81
BMI	23.1 ± 3.72
Smoking	73 (19.7)
Aspirin	41 (11.1)
Concomitant diseases	110 (29.7)
Hypertension	62 (56.4)
Anemia	39 (35.5)
Thyroid diseases	21 (19.1)
Diabetes mellitus	19 (17.3)
Multimorbidity	110 (29.7)
Operation duration (total, hours)	4.2 ± 1.3
Plastic, esthetic and reconstructive body surgeries	258 (69.7)
Plastic esthetic surgery on the face	112 (30.3)

Data presented as *n* (%), *n*: No. of patients, %: Percentage of patients, *M* $\pm$ *m*: Mean $\pm$ standard deviation. BMI: Body mass index

Univariate analysis indicated that patients older than 55 years had a higher incidence of post-operative complications than younger patients, with rates of 24.4% versus 8.7% ($P < 0.002$). In addition, those who regularly used aspirin before surgery had a significantly higher complication rate of 58.5% compared to 15.9% in those without a history of aspirin use ($P < 0.001$), despite all patients discontinuing aspirin 10 days before surgery [Table 2].

When examining complications by gender, women had a higher rate of complications than men (17.4% vs. 14.5%), although this difference was not statistically significant ($P < 0.07$). Among patients with a BMI >25 , 31 individuals (19.5%, $P < 0.03$) encountered post-operative complications, which was notably higher than those with a lower BMI (12.4%). A surgical duration exceeding 5 h was linked to an increased complication rate (19.2% vs. 15.6%), but this was not statistically significant ($P < 0.237$) [Table 2].

Multivariate analysis identified aspirin use and multimorbidity as independent risk factors. The occurrence of post-operative hematomas was significantly higher in women (9.5%) than in men (5.5%, $P < 0.011$). Patients who used antiplatelet agents

before surgery and those with multimorbidity exhibited a strong tendency toward a higher incidence of hematomas ($P < 0.002$ and $P < 0.017$, respectively).

Patients with a BMI >25 also had a significantly higher risk of developing hematomas ($P < 0.024$). Elderly patients (>55 years) had an increased incidence of post-operative hematomas [Table 3], which was statistically significant in univariate analysis ($P < 0.05$).

The incidence of hematomas did not differ significantly between patients who underwent body surgery alone and those who underwent additional concomitant procedures. When all risk factors were assessed using multivariate analysis, aspirin use and multimorbidity were independent predictors of post-operative hematoma development ($P < 0.028$).

Of the 63 complications after surgery, most indicated localized inflammatory and vascular reactions to the procedure. Hematoma and chemosis comprised 70% of these incidents, suggesting that microvascular instability and cytokine-driven permeability were key factors in post-operative complications. Minor wound infections occurred in

Table 2: Risk factors for complications in included patients

Characteristics (n=370)	All patients n (%)	Complications			
		Univariate analysis		Multivariate analysis	
		n (%)	P-value	Multivariate OR (95% CI)	P-value
Gender					
Men	55 (14.9)	5 (14.5)	0.071	-	-
Women	315 (85.1)	55 (17.4)			
Age					
<55	173 (46.8)	15 (8.7)	0.041	2.8 (0.82–7.3)	0.06
>55	197 (53.2)	48 (24.4)			
Hypertension					
Yes	162 (43.7)	30 (18.5)	0.077	-	-
No	208 (56.2)	33 (15.9)			
Taking an antiplatelet drug (aspirin, clopidogrel)					
Yes	41 (11.1)	24 (58.5)	0.002	4.8 (12.7–25.9)	0.01
No	329 (88.9)	39 (11.9)			
BMI					
<24	129 (34.9)	16 (12.4)	0.03	0.51 (0.28–1.2)	0.07
>25	241 (65.1)	47 (19.5)			
Operating room stay time					
<4	230 (62.2)	36 (15.6)	0.062	-	-
>4	140 (37.8)	27 (19.2)			
Concomitant diseases					
<2	311 (84.1)	34 (10.9)	0.001	5.2 (10.3–30.3)	0.01
>2	59 (15.9)	31 (52.5)			

Data presented as n (%), n: No. of patients, %: Percentage of patients, $P < 0.05$. OR: Odds ratio, CI: Confidence interval, BMI: Body mass index

Table 3: Risk factors for hematoma development in included patients

Characteristics (n=33)	Complications			
	Univariate analysis		Multivariate analysis	
	n (%)	P-value	Multivariate OR (95% CI)	P-value
Gender				
Men	3 (5.5)	0.05	2.42 (1.93–2.88)	0.06
Women	30 (9.5)			
Age				
<55	10 (5.8)	0.04	1.94 (1.36–2.73)	0.06
>55	23 (11.7)			
Hypertension				
Yes	17 (10.4)	0.07	0.53 (0.19–1.03)	0.06
No	16 (7.7)			
Taking an antiplatelet drug (aspirin, clopidogrel)				
Yes	12 (29.3)	0.002	5.3 (2.1–10.05)	0.001
No	21 (6.3)			
BMI				
<25	7 (5.4)	0.04	0.72 (0.27–1.09)	0.05
>25	25 (10.3)			
Operating room stay time				
<4	19 (8.3)	0.06	0.77 (0.38–1.42)	0.06
>4	14 (10.0)			
Concomitant diseases				
<2	18 (5.8)	0.002	2.49 (1.44–5.61)	0.001
>2	15 (25.4)			

Data presented as n (%), n: No. of patients, %: Percentage of patients, P<0.05. OR: Odds ratio, CI: Confidence interval, BMI: Body mass index

7.9% of the cases and typically resolved with conservative treatment. Although there were no cases of sepsis or systemic inflammatory response, local inflammation was apparent through tissue swelling and delayed healing.

DISCUSSION

Plastic and esthetic surgeries remain among the most frequent cosmetic procedures performed globally, including in Kyrgyzstan. This study examined complications after body and facial plastic surgeries in patients at private surgical facilities in Kyrgyzstan.

This study showed a complication rate of 17%, aligning with international figures that vary between 10% and 18% based on surgery type, duration, and patient comorbidities than those compared to other studies.^[13-15] In this study, individuals aged ≥55 years faced a notably higher risk of complications following facial and body plastic surgeries. In addition, a history of aspirin consumption and elevated BMI contributed to this increased risk. Hematoma was the most frequently observed complication, occurring in 4.6% of cases, consistent with previous studies that reported hematoma rates between

1.8% and 9%.^[16,17] For instance, Matarasso *et al.* found a postoperative bleeding rate of 4.4% among 12,325 patients.^[8] Similarly, Jones and Grover reported an overall hematoma rate of 4.4% in a study involving 910 patients.^[18]

Our research showed that hematoma development following facial plastic surgery was greater in men, overweight individuals, those with a history of aspirin consumption, and hypertensive patients. Similarly, Grover *et al.* identified a strong link between hematoma occurrence and systolic blood pressure, gender, aspirin usage, and smoking.^[19] In our study, the incidence of hematoma in men undergoing facelift was 11.7%, which is consistent with other studies, where the rates ranged from 7.9% to 12.9%.^[8,20,21] We advise informing male patients of the higher complication risks, and surgeons should focus on prevention strategies.

International studies have established a link between an elevated BMI and a higher incidence of complications in various plastic surgeries. Obesity, defined as a BMI >30, has been associated with an increased risk of complications, including VTE.^[21,22] In our study, a BMI exceeding 25 emerged as a statistically significant risk factor for complications, such as hematomas.

In esthetic surgery, post-operative inflammation involves local cytokine cascades that affect wound healing.^[23] When dysregulated, this process can lead to tissue edema, chemosis, or minor infections, which is consistent with our findings. Chemosis, observed in 17.5% of patients, is linked to histamine release from mast cells and vascular endothelial growth factor-induced endothelial leakage.

Baker *et al.* recommended discontinuing antiplatelet medications, such as aspirin and aspirin-containing products, 2 weeks before surgery and 1 week after surgery.^[24] The impact of aspirin on platelets persists for their entire lifespan of approximately 10 days. Our patients were instructed to stop taking aspirin and related drugs 2 weeks before the operation. In our study, aspirin use emerged as a significant independent risk factor for complications or hematoma development, leading us to adjust the pre-operative cessation period. Patients preparing for plastic surgery while on antiplatelet agents are now advised to stop aspirin 1 month before the procedure.

In our patient group, hypertension did not present as a significant risk factor for hematoma formation, with no statistically significant difference. Hematoma occurrence in these patients was 10.4%, compared to 7.7% in those without a history of hypertension. Hypertensive patients continued their prescribed blood pressure medication during the perioperative phase. Despite blood pressure management, the incidence of hematoma was slightly higher in patients with hypertension. A study by Rees *et al.* indicated that pre-operative and post-operative blood pressure do not influence hematoma rates during rhytidectomy.^[17]

Abdominoplasty alone has a higher VTE rate than other plastic surgery procedures, ranging from 1.4% to 2%. When combined with other procedures, the incidence increases to approximately 6.6%.^[25,26] Hester *et al.* reported similar VTE complications when abdominoplasty was performed with other procedures.^[27] All surgical patients are at risk of developing DVT. In general surgery patients, the post-operative DVT incidence ranges from 16% to 30%, with a pulmonary embolism rate of 1.6%.^[18,28] Few studies have documented the incidence of VTE in patients undergoing plastic surgery. According to Grazer and Goldwyn,^[26] the incidence of VTE in esthetic surgery is 1.2%, with 0.8% pulmonary embolism occurring among patients undergoing abdominoplasty.^[29] In our patient cohort, there were no cases of pulmonary VTE, although a fatal case occurred at another private plastic surgery center.

Plastic surgeons require more data to apply this model effectively, which can be obtained from the ongoing VTE prevention study funded by the Plastic Surgery Educational Foundation.^[30] Our findings should motivate plastic surgeons to integrate VTE prophylaxis into their practice and monitor VTE signs and symptoms.

This study has some limitations in interpreting the results. First, its retrospective observational design limits causal inference between risk factors and post-operative complications. Second, conducted at two centers in Kyrgyzstan, the findings may not be generalizable to other populations, healthcare systems, or surgical settings. Third, the 30-day follow-up may have underestimated the delayed complications, especially venous thromboembolic events and wound healing outcomes. Fourth, although complications were analyzed immunologically, inflammatory biomarkers, cytokines, endothelial activation markers, platelet function, and NETs were not assessed. Finally, few complications restricted the procedure-specific subgroup analyses. Future prospective multicenter studies with larger samples, longer follow-ups, and biomarker-based immune and coagulation profiling are needed to clarify the mechanisms of post-operative complications in esthetic surgery and evaluate personalized thromboprophylaxis, perioperative antiplatelet management, and validated risk prediction models. Clinically, our findings emphasize the importance of pre-operative risk assessment, especially for older patients with comorbidities and a high BMI, as well as monitoring, counseling, optimization of modifiable risk factors, and antiplatelet management.

CONCLUSION

Post-operative complications were noted in 17% of patients undergoing plastic, esthetic, and reconstructive surgery, with hematoma being the most common issue. Older age, higher BMI, prior antiplatelet therapy, and multiple health conditions were associated with a greater likelihood of complications. Aspirin use and multiple health conditions were independent predictors of post-operative hematoma. These results emphasize the importance of personalized pre-operative assessments and risk evaluation in esthetic surgery. Although no venous thromboembolic events were detected, their potential seriousness highlights the need for ongoing vigilance and preventive measures in future studies. A deeper insight into the interactions among inflammation, coagulation, and wound-healing pathways could aid in the development of targeted perioperative strategies that enhance patient safety and surgical outcomes.

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INFORMED CONSENT STATEMENT

Informed consent was obtained from all subjects involved in the study.

DATA AVAILABILITY STATEMENT

Data are available from the corresponding author upon reasonable request.

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