



# Emergency room visits for severe complications after cosmetic surgery

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**Background** Because many cosmetic surgery clinics are not adequately equipped to handle emergent conditions, patients often come to a university hospital when problems occur during or after cosmetic surgery. However, few in-depth studies have been conducted of this issue. Therefore, we investigated emergency department visits due to complications associated with cosmetic surgery.

**Methods** A retrospective chart review was conducted of 38 patients who visited the emergency department of the authors' institution due to complications associated with cosmetic surgery from July 2014 to June 2017.

**Results** There were more women than men (30 women vs. 8 men). Their mean age was 32.4 years (range, 19–57 years). Upon presentation to the emergency department, patients' vital signs and mental status were usually normal (27 normal vs. 11 abnormal). The types of surgery included blepharoplasty, rhinoplasty, malar/orthognathic surgery, mammoplasty, liposuction, fat grafting, and filler and botulinum toxin injections. Most patients required hospitalization (26 admitted vs. 12 discharged). Eight of the hospitalized patients required intensive care unit care, of whom two died and three experienced brain death or had permanent neurologic sequelae.

**Conclusions** The complications were usually minor problems, despite the need for hospitalization, but some complications were life-threatening. We recommend close monitoring and maintaining an adequate injection capacity for intravenous sedative anesthesia. When any symptom or sign of a complication occurs, it is best to transfer the patient to a university hospital as soon as possible. Taking a careful medical history is always needed, even for minor procedures.

**Keywords** Anesthesia / Cardiomyopathies / Epinephrine / Plastic surgery

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## INTRODUCTION

In Korea, since the 1980s, with the rapid development of the mass media and the information technology industry, perceptions have changed and concerns about appearance have become more open

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and widespread. As a result, cosmetic surgery has become positively recognized and popularized. According to the International Society of Aesthetic Plastic Surgery, South Korea is the country with the fourth highest number of cosmetic procedures. As a result, concerns about safety in plastic surgery are also growing rapidly. However, many cosmetic surgery clinics are not appropriately equipped to handle emergent conditions, and most plastic surgeons are also not prepared to manage such situations. Therefore, when a serious problem occurs during or after cosmetic surgery, patients are often transferred to larger medical centers, especially university hospitals. In Korea, most cosmetic procedures are performed in outpatient offices. In the United States, the American Society of Plastic Surgeons Board of Directors convened the Task Force on Patient Safety in Office-Based Surgery Facilities in 2002. The Task Force has published several statements and advisories to

assist physicians in clinical decision-making, emphasizing patient safety as the foremost concern in the practice of plastic surgery [1]. Many authors have emphasized the development of a quality care system, patient selection, preoperative examinations, and postoperative management [2]. Especially for liposuction, they suggest using a patient selection checklist, risk assessment tool, and thromboprophylaxis protocol. In a review of the safety outcomes of office-based plastic surgery [3], the rates of hospital admission, thromboembolism, and emergency department visits were analyzed. This analysis showed significant variability for every item, and revealed that some facilities had complication rates that were a statistically significant deviation from the mean. The author emphasized the necessity of analyzing outliers and of improving the current licensure and reporting system. In Korea, cosmetic procedures are not included in the national health care system, so there are no precise statistical data on safety outcomes. Furthermore, as most plastic surgery clinics are run by independent individuals, there is no unified system of patient safety. Furthermore, plastic surgeons in Korea have much weaker perceptions of safety than those in the United States. Therefore, by conducting a study of emergency department visits due to complications associated with cosmetic surgery, we hope to raise surgeons' awareness of the need for safety in cosmetic procedures. We also emphasize the necessity of nationwide research on this topic. Finally, we hope that this article will contribute to the development of a high-quality safety protocol for cosmetic surgery.

**Table 1.** Diagnoses of patients classified by their vital signs and mental status

Diagnosis	No. of patients
Normal vital signs and mental status	
Cellulitis&wound infection	10
Hematoma	5
Postoperative bleeding&hypovolemia	4
Vasovagal syncope	4
Postoperative pain	2
Emphysema	1
Hyperventilation	1
Total	27
Abnormal vital signs and mental status	
Stress-induced cardiomyopathy	6
Postural orthostatic tachycardia syndrome	1
Brain hemorrhage	1
Cerebral infarction	1
Metabolic encephalopathy	1
Sepsis	1
Total	11

## METHODS

A retrospective chart review was conducted of patients who visited the emergency department of the Soonchunhyang University Hospital due to complications associated with cosmetic surgery. We requested the emergency department to contact us about such patients during the study period. We also reviewed the emergency department charts comprehensively. We included all diagnoses associated with cosmetic procedures, but excluded patients whose symptoms had an unclear relationship with a previous procedure. Forty-one such patients were identified from July 2014 to June 2017. We traced the clinical course of all the included patients, analyzing patients in terms of their hospitalization status, vital signs, mental status, and type of anesthesia. Patients who had severe complications and were transferred to the intensive care unit were reviewed more thoroughly. We reviewed patients' general information, the type of surgery and anesthesia, the final diagnosis and treatment, the time taken to visit the emergency department, and the final clinical outcome. We compared the proportion of patients with stable vital signs and unstable vital signs. For the statistical analysis, we used the Fisher exact test. The requirement for informed consent was waived, and this investigation was approved by the Institutional Review Board of Soonchunhyang University (IRB No. SCHUH 2017-06-013).

## RESULTS

There were more women than men (30 women vs. 8 men). Their mean age was 32.4 years (range, 19–57 years). Upon presentation to the emergency department, most patients' vital signs and mental

**Table 2.** Types of aesthetic procedures received by patients

Procedure	No. of patients
Normal vital signs and mental status	
Liposuction	7
Mammoplasty	6
Malar&orthognathic surgery	6
Filler injection	4
Rhinoplasty	2
Botox injection	1
Blepharoplasty	1
Total	27
Abnormal vital signs and mental status	
Liposuction	5
Mammoplasty	4
Rhinoplasty	1
Botox injection	1
Total	11

status were normal (27 normal vs. 11 abnormal). The diagnoses of the patients who presented in a normal condition included cellulitis/wound infection, hematoma, postoperative pain, and vasovagal syncope. The diagnoses of patients who presented in an abnormal condition included stress cardiomyopathy, cerebral infarction, brain hemorrhage, and sepsis (Table 1). The types of surgery included mammoplasty, liposuction, malar/orthognathic surgery, rhinoplasty, filler and botulinum toxin injections, and blepharoplasty (Table 2). The most common procedures in patients with abnormal vital signs were liposuction and mammoplasty. Twenty-one patients underwent surgery under general anesthesia, eight under local anesthesia, and nine under intravenous (IV) sedation (Table 3). The most common complication in patients who underwent general anesthesia was hematoma, while cellulitis was most common among those who underwent local anesthesia.

We analyzed the proportion of unstable patients according to anesthesia type. Table 4 presents a comparison of the proportion of patients who had unstable vital signs. A higher proportion of patients with unstable vital signs was found among patients who received general anesthesia and sedation than among those who received local anesthesia (33.3%, 33.3%, 12.5%, respectively). How-

**Table 3.** Diagnoses of patients classified by anesthesia type

Anesthesia	Diagnosis	No. of patients
General anesthesia	Hematoma	6
	Cellulitis&wound infection	2
	Postoperative bleeding&hypovolemia	2
	Vasovagal syncope	2
	Postoperative pain	1
	Hyperventilation	1
	Stress-induced cardiomyopathy	3
	Postural orthostatic tachycardia syndrome	1
	Brain hemorrhage	1
	Cerebral infarction	1
	Sepsis	1
Total	21	
Local anesthesia	Cellulitis&wound infection	5
	Vasovagal syncope	2
	Stress-induced cardiomyopathy	1
Total	8	
Intravenous sedation	Postoperative pain	2
	Hematoma	1
	Postoperative bleeding&hypovolemia	1
	Vasovagal syncope	1
	Emphysema	1
	Stress-induced cardiomyopathy	2
	Metabolic encephalopathy	1
	Total	9

ever, this trend showed no statistical significance.

Eight of the hospitalized patients required care in the intensive care unit. Of those eight patients, two died and three experienced brain death or had permanent neurologic sequelae (Fig. 1). The severe cases varied in terms of surgery type, anesthesia, and diagnosis, and were usually associated with the patient's general condition, rather than surgical malpractice (Table 5).

**Case 1**

A 54-year-old woman underwent liposuction under IV sedation. During surgery, cardiac arrest occurred and the medical team immediately performed cardiopulmonary resuscitation and intubated the patient. It took 30 minutes for her to reach the emergency department. Her diagnosis was stress-induced cardiomyopathy. Extracorporeal membrane oxygenation was applied, and because of her low blood pressure and operative site bleeding, an emergency exploratory laparotomy was performed. However, there was no active bleeding. The patient developed multiorgan failure and died the next day.

**Case 2**

A 26-year-old woman underwent liposuction under IV sedation. During surgery, her heart rate decreased to 20 beats per minute. The medical team immediately performed cardiopulmonary resuscitation, intubated her, injected epinephrine, and then checked her pulse. It took 30 minutes for the patient to reach the emergency department. Her diagnosis was stress-induced cardiomyopathy, and the cardiac ejection fraction was 20%. The patient received hypothermia therapy, but developed hypoxic brain damage.

**Case 3**

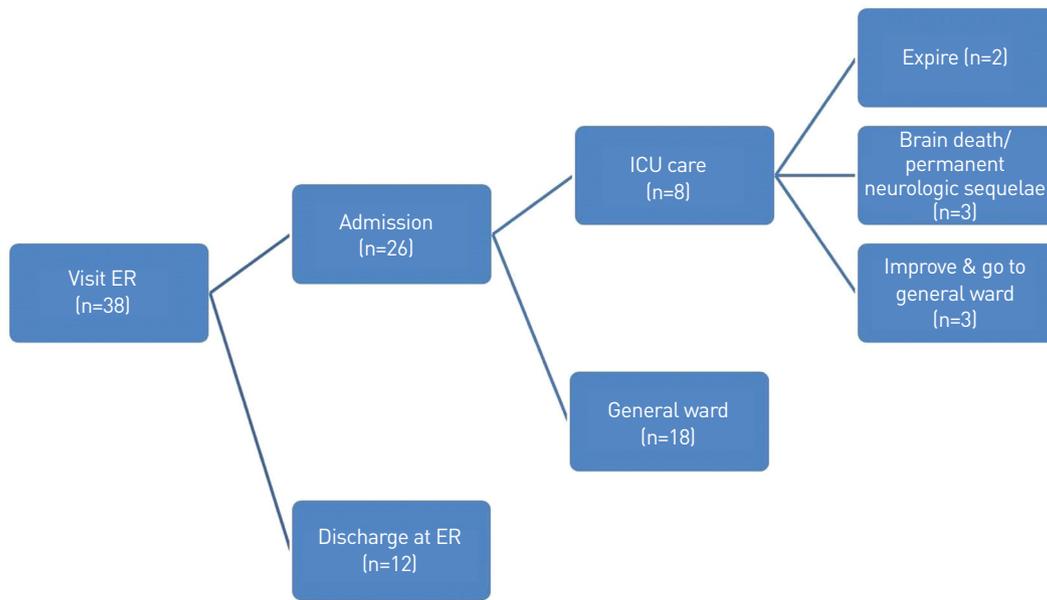
A 20-year-old woman underwent rhinoplasty under general anesthesia. During surgery, arrhythmia occurred and oxygen saturation decreased to 92%. After 15 minutes, asystolic arrest occurred. The medical team immediately performed cardiopulmonary resuscitation, intubation, and cardioversion. It took 30 minutes for the patient to reach the emergency department, and the initial pulse rhythm was ventricular fibrillation. Defibrillation and extracorporeal membrane oxygenation were performed. The patient experienced hypoxic brain damage, developed multiorgan failure, and died after a week.

**Table 4.** Vital signs according to anesthesia type

Anesthesia	General (n=21)	Local (n=8)	Sedation (n=9)	P-value <sup>a)</sup>
Vital sign				0.626
Stable	14 (66.7)	7 (87.5)	6 (66.7)	
Unstable	7 (33.3)	1 (12.5)	3 (33.3)	

Values are presented as number/total number (%).

<sup>a)</sup>P-values were calculated with the Fisher exact test.



**Fig. 1.** Treatment and prognosis of patients. ER, emergency room; ICU, intensive care unit.

**Table 5.** Analysis of patients transferred to the intensive care unit

Case no.	Sex/age (yr)	Type of procedure	Type of anesthesia	Diagnosis	Time from symptom onset to visiting ED	Treatment	Prognosis
1	F/54	Liposuction	IV sedation	Stress-induced cardiomyopathy	30 min	Cardiopulmonary resuscitation, ECMO, exploratory laparotomy	Multiorgan failure, death
2	F/26	Liposuction	IV sedation	Stress-induced cardiomyopathy	30 min	Cardiopulmonary resuscitation, hypothermal therapy	Hypoxic brain damage, transferred to another hospital
3	F/20	Rhinoplasty	General anesthesia	Stress-induced cardiomyopathy	30 min	Cardiopulmonary resuscitation, ECMO	Hypoxic brain damage, multiorgan failure, death
4	F/36	Liposuction	General anesthesia	Cerebral infarction	2 hr	Decompressive craniectomy, right temporal lobectomy	Remained in a stupor, transferred to another hospital
5	F/23	Augmentation mammoplasty	General anesthesia	Stress-induced cardiomyopathy	30 min	Cardiopulmonary resuscitation, conservative treatment	Discharged without sequelae
6	F/35	Augmentation mammoplasty	General anesthesia	Sepsis, acute kidney injury, congestive hepatopathy, pulmonary congestion, congestive heart failure	1 day	Conservative treatment	Discharged without sequelae
7	F/24	Reduction malarplasty & submental liposuction	General anesthesia	Subdural hemorrhage, subarachnoid hemorrhage	6 hr	Conservative treatment	Brain death, transferred to another hospital
8	F/19	Fat graft	IV sedation	Metabolic encephalopathy	10 hr	Conservative treatment	Discharged without sequelae

ED, emergency department; F, female; IV, intravenous; ECMO, extracorporeal membrane oxygenation.

**Case 4**

A 36-year-old woman underwent liposuction under general anesthesia. After 1 week, the patient complained of abdominal pain, vomiting, diarrhea, and even loss of consciousness. It took 2 hours

for her to reach the emergency department. The diagnosis was hemorrhagic transformation of a cerebral infarction. She received emergency decompressive craniectomy with a right temporal lobectomy. However, she remained in a stupor.

### Case 5

A 24-year-old woman underwent reduction malarplasty and submental liposuction under general anesthesia. When the patient was recovering in the ward after surgery, she was found to have an abnormal mental status. It took 6 hours for her to reach the emergency department. The diagnosis was subdural hemorrhage and subarachnoid hemorrhage. The patient eventually developed brain death.

## DISCUSSION

In general, most plastic surgeons do not worry about post-procedural death, because of the low mortality rate of aesthetic procedures. The riskiest aesthetic procedures are buttock augmentation and abdominoplasty, with risks of mortality of 1 in 3,000 and 1 in 18,000, respectively [4]. For those procedures, the major cause of mortality is deep vein thrombosis. In general surgery and orthopedic surgery, the risk is even more severe. The incidence of postoperative deep vein thrombosis in general surgery patients ranges from 16% to 30%, with an incidence of clinically significant pulmonary embolism of 1.6% and an incidence of fatal pulmonary embolism of 0.1%–0.8% [5,6]. The incidence is even higher for orthopedic surgery patients undergoing hip or knee surgery. Without adequate thromboembolic prophylaxis, 45%–70% hip surgery patients and 53%–84% knee surgery patients will develop deep vein thrombosis [7,8]. It has been found that 10% of cases of deep vein thrombosis led to an immediately fatal pulmonary embolism [8,9], while 5% caused death later [9,10]. Although the incidence of fatal pulmonary embolism may seem very low in a surgeon's personal practice, pulmonary embolism accounts for over 200,000 deaths per year in the United States alone [11,12]. Therefore, many plastic surgeons in the United States emphasize the need to acknowledge the risk of thromboembolism. They recommend a comprehensive risk assessment for thromboembolism, as well as mechanical and pharmacological prophylaxis [13].

However, the mortality rate of other procedures is much lower, so most concerns have focused on other factors, such as the patient's comorbidities, sedation, or anesthesia. Many surgeons tend to leave the mortality rate to fate. According to the International Survey on Aesthetic/Cosmetic Procedures, which was conducted in 2014, only about 7,000 cases of abdominoplasty and 1,500 cases of buttock augmentation were done in Korea. Many fewer such procedures were performed in Korea than in the United States (120,000 abdominoplasties and 20,000 buttock augmentations); this disproportionality remains striking even when accounting for the larger population of the United States. Therefore, prophylaxis against deep vein thrombosis has received much less attention in Korea.

A notable aspect of our findings is that many patients were diagnosed with stress-induced cardiomyopathy, which is also known as

Takotsubo cardiomyopathy and broken heart syndrome. Its pathophysiology is as follows. When a catecholamine surge occurs, excessive sympathetic stimulation of the myocytes of the heart causes the heart to weaken suddenly. It is similar to an acute myocardial infarction, but does not involve coronary artery obstruction. Many patients recover without complications, but some may experience congestive heart failure, cardiogenic shock, and even death. Various causes have been suggested, including neurologic or psychiatric disorders, preoperative antibiotic injections, old age in women, and epinephrine injections [14,15]. Two articles have investigated the relationship between stress-induced cardiomyopathy and epinephrine injections. The authors warned that the syndrome can occur in young patients and they recommended that local anesthetics with epinephrine should be injected slowly, while carefully monitoring the patient's heart rate [16,17]. The initial sign of this syndrome is increasing blood pressure and heart rate after an injection. Subsequently, oxygen saturation and blood pressure decrease, while pulmonary secretions increase. Early recognition and appropriate therapy, including beta blockers, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, and mechanical support of circulation in the acute phase, are needed for patients to recover [18,19].

The physiological mechanism relating perioperative stress to stress-induced cardiomyopathy remains unclear because of its multifactorial pathogenesis and because its true etiology is still unknown. Although sometimes no triggering factor is identified, an association with emotional and/or physical stress is present in approximately two-thirds of patients who develop stress-induced cardiomyopathy [20–22].

Currently, the most accepted etiology of stress-induced cardiomyopathy is that stressful stimuli cause a significant increase in catecholamine release by increased sympathetic stimulation. This can cause myocardial adrenergic stimulation and consequent changes in contractility and transient heart dysfunction [23–25]. Surgery involving anesthesia is inherently a stressful event for these patients that initiates a cascade of physiological and metabolic events through direct activation of the sympathetic and somatic nervous system, with a significant increase in plasma catecholamines that begins in the pre-anesthetic period and ends within 3 to 4 days postoperatively. However, a clear explanation for individual differences in susceptibility to cardiomyopathy after exposure to a similar degree of stress is unknown, although it may be due to genetic heterogeneity associated with adrenergic receptors, which makes them more or less sensitive to stimuli [26,27].

No anesthetic or surgical strategy has clearly been established in the literature as a way to prevent the occurrence of stress-induced cardiomyopathy in patients requiring surgical intervention. However, the safest option appears to be to use the lowest possible stimulation with rigorous monitoring to promptly diagnose any possible acute complication during the perioperative period. In the pre-

operative period, the time before the surgical procedure itself and the patient's emotional imbalance should be minimized to provide a deeper level of anxiolysis using pharmacological and psychological approaches before the patient is taken to the operating room [28-31].

In this study, we found some cases of fatal postoperative complications associated with a cosmetic procedure. To some extent, such complications can be controlled by the surgeon, in addition to the possible impacts of patient- or anesthesiology-related factors. With appropriate acknowledgement of this kind of complication, it may be possible to develop a safety guideline for surgeons to reduce the possibility of fatal complications due to epinephrine injections.

There were some limitations of this study. First, our study involved a chart review limited to the emergency department of the authors' hospital. Therefore, our findings may not be generalizable to a broader setting. Nonetheless, our institution is one of the closest medical centers to the Gangnam district, where many plastic surgery clinics are located. Therefore, we suggest that our data may be representative of cosmetic surgery patients in Gangnam. We could not achieve meaningful values from the statistical analysis, due to the insufficient number of patients. A larger study is needed for a more precise and significant analysis. We are planning to collect information on relevant parameters prospectively, when patients reach the emergency department.

The complications were usually minor problems, but some complications were life-threatening. In particular, a higher level of awareness of stress-induced cardiomyopathy among practicing surgeons is needed. As ways to minimize the risk of complications, we recommend a careful assessment of each patient's history, a slow injection of local anesthesia, and close monitoring.

## NOTES

### Conflict of interest

No potential conflict of interest relevant to this article was reported.

### Ethical approval

The study was approved by the Institutional Review Board of Soonchunhyang University (IRB No. SCHUH 2017-06-013) and performed in accordance with the principles of the Declaration of Helsinki.

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