

Safety Comparison of Abdominoplasty and Brazilian Butt Lift: What the Literature Tells Us

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Background: Although abdominoplasty is a mainstay of the plastic surgeon, the safety of the Brazilian butt lift (BBL) has been questioned, effectively being prohibited in some countries. The central rationale for the safety concern over the BBL stems from a publication stating a mortality rate of one in 3000. The question remains: What is the real safety of these procedures?

Methods: Focusing on mortality, literature searches were performed for BBL and for abdominoplasty. The 2017 Aesthetic Surgery Education and Research Foundation survey data and publication were examined and analyzed. Additional data from the American Association for Accreditation of Ambulatory Surgical Facilities were obtained independently.

Results: Abdominoplasty and BBL appear to have similar safety based on mortality; however, the nature of their mortalities is different. Although most abdominoplasty deaths are secondary to deep venous thrombosis/pulmonary embolism—inherent circulatory thrombotic abnormality—BBL mortality is associated with iatrogenic pulmonary fat embolism. BBL mortality rates from more recent surveys on BBL safety demonstrate a mortality of one in 15,000.

Conclusions: Although deep venous thrombosis/pulmonary embolism will always remain an abdominoplasty risk, intraoperative BBL pulmonary fat embolism has the potential to be reduced dramatically with a better understanding of dynamic anatomy, surgical instrumentation, and technique. The authors are now presented with a better lens with which to view a more accurate safety profile of BBL surgery, including its place among other commonly performed aesthetic procedures. (*Plast. Reconstr. Surg.* 148: 1270, 2021.)

Abdominoplasty and Brazilian butt lift (BBL) are two popular operations in body contouring surgery. In contrast to growth-stable abdominoplasty rates in the United States and the United Kingdom, BBL demonstrates high procedural growth (Fig. 1).

BBL is also in a state of technical flux. Recently, plastic surgeons in leadership positions have considered calling for a moratorium on the procedure in the United States because of perceived mortality rates.¹ In some countries, despite no official societal or governmental ban, it is “highly

suggested” that the procedure not be performed until further data are available, and the operation is effectively prohibited.²

The central rationale for discussing a ban on the BBL stems from a survey study publication from the United States showing a mortality rate of one in 3000.³ Additional evidence presented by proponents of a ban on BBL includes articles in the lay press depicting patients who have died from BBL surgery.

Over the past 5 to 7 years, new techniques of large-volume fat grafting have emerged. Expansion vibration lipofilling combined with safe subcutaneous buttock augmentation has been described and published in the plastic surgery literature.

The fundamental question remains: What is the real mortality rate for BBL and how does it compare to other body contouring procedures?

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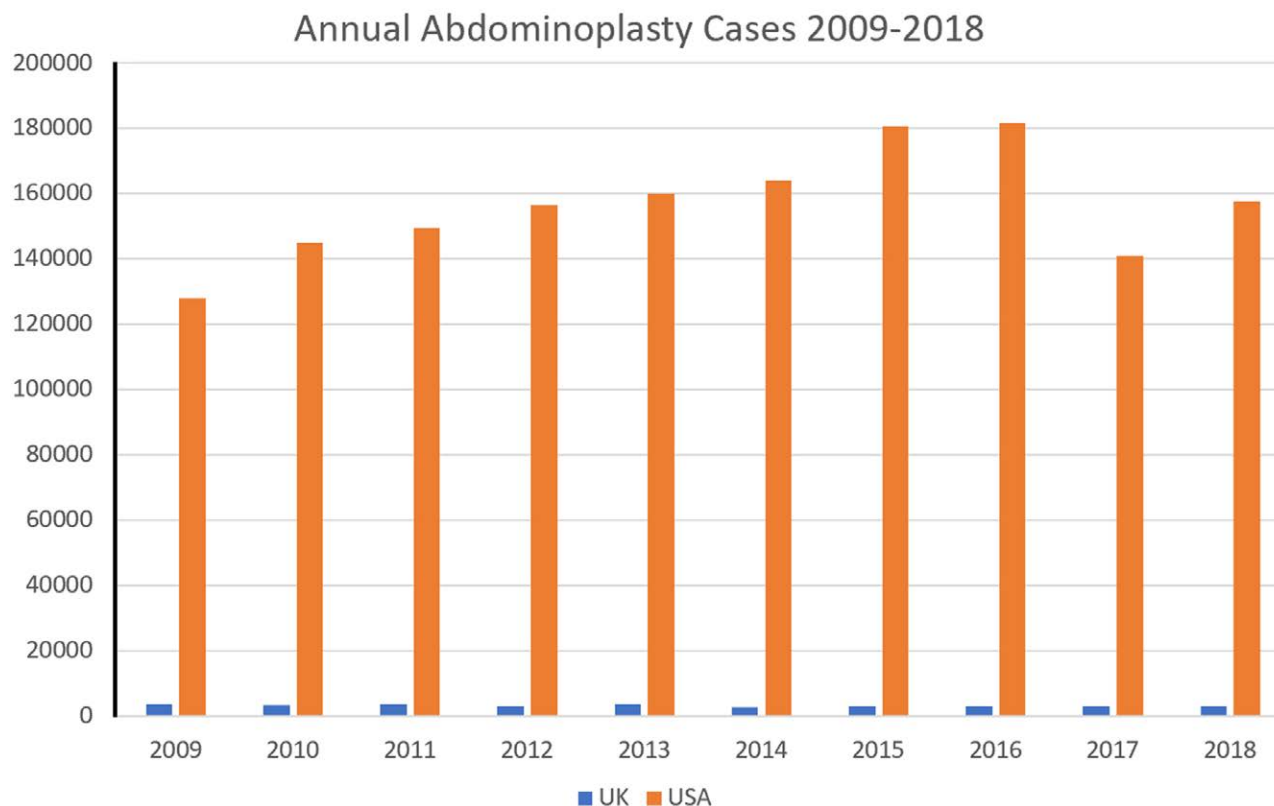


Fig. 1. Growth-stable abdominoplasty rates in the United States and the United Kingdom.

The purpose of the present communication is to review the true mortality data from published abdominoplasty communications and to compare them to what literature and evidence is currently available regarding the mortality rate of BBL, to make a logical conclusion of the accurate risks of each procedure.

PATIENTS AND METHODS

Literature searches were performed using Google and Ovid databases in the field of plastic and reconstructive surgery. English-language scientific publications about abdominoplasty and its complications were analyzed using PubMed.gov, through December of 2019. Five terms were used to search for abdominoplasty complications: “abdominoplasty,” “abdominoplasty and complications,” “abdominoplasty and fatal complications,” “abdominoplasty and complications and death,” and “abdominoplasty and death.” Abdominoplasty articles that queried survey study mortality rates were also searched, and abdominoplasty publications that contained true clinical series data on mortality rates were identified. A similar search analysis was applied for BBL publications.

RESULTS

The most clinically relevant articles were selected that most closely addressed the specific question of mortality. The data in [Table 1](#) depict the search results on the publications that explicitly mention or include data on mortality rates for either abdominoplasty or BBL.

Mortality rates for abdominoplasty from published survey studies and from clinical series ranged from one in 2400 to one in 13,000. No clinically relevant articles exist on BBL mortality that involve a retrospective, prospective, or registry series of cases. As depicted in [Table 1](#), the mortality for BBL surgery from survey studies ranged from one in 3000 to one in 20,000, with an average mortality of one in 12,700 ([Table 1](#)).

DISCUSSION

There have been many publications on abdominoplasty surgery that focus on a wide variety of patient safety topics.⁴⁻¹³ Relevant publications on abdominoplasty mortality depicted in [Table 1](#) suggest that the mortality for abdominoplasty has trended downward over time. This is consistent with many innovations and/or

Table 1. Summary of Most Relevant Safety Articles on Abdominoplasty and BBL

First Author's Name	Procedure Type	Publication Year	Journal	Study Type	Respondents/ Patients (Study Size)	Response Rate (%)	Mortality Rate
Temourian	Abdominoplasty	1989	PRS	Survey	935 respondents	35	1:2415
Hughes	Abdominoplasty	2000	ASJ	Survey	754 respondents	53	1:3281
Matarasso	Abdominoplasty	2006	PRS	Survey	497 respondents	15	No rate
Keyes	Abdominoplasty	2017	ASJ	Series	354,391 patients	NA	1:13,000
Mofid	BBL	2017	ASJ	Survey	692 respondents	14	1:3000
Conde Green	BBL	2019	PRS	Survey	853 respondents	15	1:20,000
Rios	BBL	2020	ASJ	Survey	912 respondents	19	1:15,000

PRS, *Plastic and Reconstructive Surgery*; ASJ, *Aesthetic Surgery Journal*; NA, not applicable.

techniques in plastic surgery, where procedural advances, improved instrumentation, and proper surgical education have led to better patient safety and safer outcomes.^{14,15}

Most clinical series articles on abdominoplasty safety have focused on local (wounds, seromas) complications, systemic complications^{16–20} and deep venous thrombosis prophylaxis.²¹ With one exception,²² no publication on abdominoplasty has ever directly focused on mortality as the central theme of its communication. Some large clinical series containing valuable mortality statistics appear to be overshadowed by the authors' preferred topic, such as liposuction or complications of deep vein thrombosis²³; some abdominoplasty mortality rates were not even mentioned and required calculation from the article's raw data.²⁴

Initial mortality rates for abdominoplasty were not insignificant. Despite this fact, efforts at reducing the risk have been successful and the procedural mortality for abdominoplasty was patiently tolerated over the past 20 years by organized plastic surgery in both the United States and the United Kingdom. Although abdominoplasty procedures performed in the United Kingdom averaged 3000 over the past 10 years,²⁵ those in the United States averaged 156,000.²⁶

In August of 2015, reports of intraoperative mortality brought attention to the dangers of pulmonary fat embolism during BBL with a series from Mexico showing multiple intraoperative fatalities from massive pulmonary fat embolism, showering the right heart with fat lobules, causing electromechanical dissociation, and resulting in sudden death on the operating table.²⁷

Increased awareness of pulmonary fat embolism from BBL in the United States shortly followed. There came a realization that deaths in the United States were occurring from this operation, with increased attention to autopsy reports and from reports in the lay press. In May of 2016, a panel on body contouring at the California Society of Plastic Surgeons Annual Meeting concluded the event and focused on BBL safety, pulmonary

fat embolism, and the anatomical proximity of the gluteal vessels to the inferior vena cava.²⁸

In August of 2016, an Aesthetic Surgery Education and Research Foundation (ASERF) Task Force was established that developed an American Society for Aesthetic Plastic Surgery member survey on BBL mortality. The Task Force also obtained cases of fatal BBL pulmonary fat embolism from national autopsy reports and presumed deaths from pulmonary fat embolism in the setting of BBL from the American Association for Accreditation of Ambulatory Surgical Facilities. Accurate numbers of total BBLs performed nationally and in American Association for Accreditation of Ambulatory Surgical Facilities were not known; however, estimates were derived from American Society for Aesthetic Plastic Surgery procedural statistics to derive denominators and therefore estimated mortality rates. In July of 2017, the Task Force's efforts culminated in a publication entitled, "Report on Mortality from Gluteal Fat Grafting: Recommendations from the ASERF Task Force." BBL mortality from this publication was estimated at one in 3000.³

This report, which used a retrospective, anonymous surgeon survey, had a 14 percent response rate.²⁹ In May of 2019, a second ASERF survey³⁰ was sent to members of the American Society for Aesthetic Plastic Surgery and the International Society of Aesthetic Plastic Surgery. The survey asked about fat embolisms and deaths associated with gluteal fat grafting in the past 24 months (the time since new subcutaneous safety recommendations were established).³¹ This survey showed a mortality rate of one in 14,921, which is in contrast to the mortality rate of one in 3000 published by the ASERF Task Force in July of 2017.³ An independent statistical analysis of the data from the 2017 ASERF study suggests that the mortality rate from the survey data in that study may actually be one in 13,000, which is similar to the ASERF 2020 survey data.³² Therefore, a *possible* alternative explanation to the discrepancy between the two ASERF survey studies on mortality rates for BBL

may be that there has been no material clinical “improvement” in BBL mortality between 2017 and 2020, as the 2020 publication surmises, but rather a *possible* miscalculation on the 2017 survey mortality rates.

The 2017 ASERF survey mortality of one in 3000 has been referenced by multiple constituents, including plastic surgeons, organized plastic surgery, and regulators.^{33–35} In October of 2019, a survey notification by the British Association of Aesthetic Plastic Surgeons recommended their members not perform BBL, citing a mortality rate of one in 3000.³⁶

In March of 2019, an article was published consisting of a BBL survey study of Brazilian plastic surgeons. This anonymous survey study stated a calculated mortality rate of approximately one in 20,000 from BBL.³⁷

The 2017 ASERF survey study stating that a BBL mortality of one in 3000 was an organized effort to collect available data, produce a rapid questionnaire, complete a survey, and publish an article—all within a 12-month time frame. This endeavor was, in retrospect, timely considering the increase in the number of deaths that were surfacing from gluteal fat grafting.

Not only did this publication increase awareness as to the gravity of the BBL procedure, but it also mobilized key opinion leaders, and led some plastic surgery organizations to recommend a halt on the procedure for its members. However, it also stimulated a flurry of independent private research that sought to understand the cause of the problem and, in doing so, to help reduce the overall incidence of fatal complications, helping it evolve into a safer and more well-executed body contouring procedure.

Several independent research studies were performed immediately after the ASERF Task Force’s article in 2017. Dynamic anatomical studies were undertaken in addition to clinical studies, which are summarized below. Endoscopic dissection of the subgluteal space revealed three major findings:

1. The subgluteal space is a relatively free space, similar to the pectoralis muscle.
2. The only fixed elements are the inferior and superior gluteal vascular leashes.
3. There is no fascia on the deep (anterior) side of the gluteus maximus muscle.

Dynamic anatomical studies were performed on cadavers, where proxy fat was injected below the fascia of the gluteus maximus muscle.

Volume/pressure curves were generated for multiple cadaver buttocks. With increased volume of injectate, an initial rise in pressure was followed by an ensuing drop in pressure, implying migration out of the muscle. After reflection of the medial origin of the muscle off the sacrum and inspection of the subgluteal space, large volumes of free proxy fat were observed to track in the subgluteal space, from the retroperitoneal space to the insertion of the gluteus maximus muscle on the femur. This confirmed the static anatomical observation that the gluteus maximus muscle, lacking a deep fascial layer, easily allows fat to migrate through it into deeper structures, and did not act as a barrier to migration or retain fat within its muscular compartment. The concept of deep intramuscular migration was developed and was felt to be a contributing factor to potential vessel damage during intramuscular insertion of fat, at any level, superficial or deep.³⁸ This served as the impetus for proposing that no intramuscular fat transplantation be undertaken in the gluteus maximus muscle.³⁹

Dynamic cadaver studies were also undertaken that focused on the suprafascial or subcutaneous space of the gluteal region. Volume/pressure curves were generated for fat in the subcutaneous space, under a variety of conditions: (1) gluteal fascia intact, (2) gluteal fascial perforated (with a cannula), and (3) gluteal fascia fenestrated with 1-cm fascial defects (using a Baker punch). When the gluteal fascia was intact, or simply perforated, subcutaneous pressure as high as 220 mmHg was generated, with no migration into the muscle or the subgluteal space. When fascial defects existed, an initial rise in pressure was followed by an ensuing drop in pressure, implying migration of injectate out of the muscle. Indeed, inspection of the subgluteal space revealed deep intramuscular migration, supporting the prior work suggesting that subcutaneous grafting and the integrity of the gluteal fascia are the keys to maintaining safe, subcutaneous buttock augmentation.⁴⁰

Clinical endoscopic inspection of the subgluteal space, performed in a patient undergoing buttock reconstruction following an infectious complication of BBL with methicillin-resistant *Staphylococcus aureus* sepsis, helped reveal dynamic properties of the gluteal veins.⁴¹ The vascular leashes of the gluteal vessels were dissected and inspected. The venous plexus of these leashes was noted to increase up to 300 percent with positive-pressure inspiration (Fig. 2).³²

Discussants of intramuscular migration and subsequent venous traction have stated they “do not believe this is a mechanism” and have

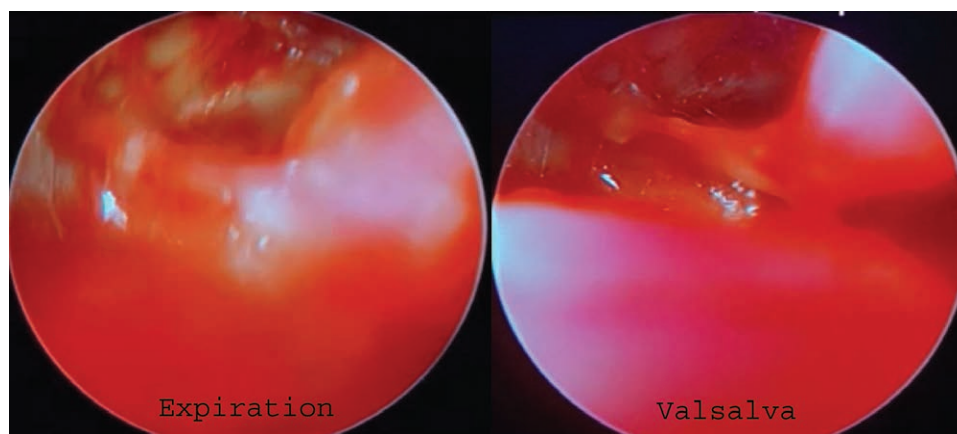


Fig. 2. Subgluteal endoscopic dissection in a patient undergoing reconstructive buttock surgery demonstrates the thin-walled fragility of the gluteal vessels seen in vivo, in addition to the three-fold expansion in vessel diameter with positive-pressure ventilation.

questioned whether these anatomical findings were sufficient enough to consider BBL safe: “the key question therefore is whether there is a technique that consistently prevents intramuscular injection. Del Vecchio is urged to demonstrate that expansion vibration lipofilling can do that.”⁴²

In 2019, an institutional review board–approved, multinational, three-continent, eight-surgeon study was performed using expansion vibration lipofilling⁴³ and safe subcutaneous buttock augmentation, with magnetic resonance imaging follow-up at 2 weeks. Surgeon experience ranged from surgeons who had performed thousands of expansion vibration lipofilling cases to surgeons who had never performed a single case of expansion vibration lipofilling before. In zero of 60 buttocks was fat found below the fascia in the gluteus maximus muscle.⁴⁴ To summarize the research findings:

1. There is a large free space under the gluteus maximus muscle; there is no fascia on the deep surface of this muscle.
2. Fat placed just under the fascia of the gluteus maximus muscle migrates through the gluteus muscle, entering the deep submuscular space, potentially injuring vessels and entering the sciatic foramen.
3. When fat is placed in the subcutaneous space, the gluteus fascia acts as an effective barrier to deep migration; even up to pressures of 200 mmHg.
4. When surgeons are trained in safe subcutaneous buttock augmentation using expansion vibration lipofilling, in zero of 60 buttocks was there inadvertent placement of fat beneath the gluteal fascia. This suggests

that surgeons can be properly trained to stay subcutaneous during gluteal fat grafting.

Since the inception of the BBL’s popularity, its initial safety literature demonstrates many similarities with those of other historically emerging body contouring procedures (i.e., abdominoplasty and liposuction). For those of us fortunate to have such a perspective, looking over a 40- to 50-year-long time horizon, the evolving BBL story suggests we are repeating similar historical challenges that plastic surgeons encountered and sorted with abdominoplasty and liposuction.

Initial published mortality rates for the abdominoplasty procedure, since its inception by Pitanguy,⁴⁵ were one in 3000 to one in 5000 and have subsequently decreased to one in 13,000. Likewise, mortality of “suction lipolysis” first introduced by Illouz to the United States⁴⁶ have decreased from one in 3000 to one in 5000, to markedly reduced rates of 1.3 in 50,000 cases, or one in 38,000⁴⁷ (Fig. 3).

In the case of liposuction, better instrumentation, improved technical education, and a practice advisory imposing limitations on volumes of aspirate and medications used (epinephrine, lidocaine) constitute major factors in reducing mortality.⁴⁸ In the case of abdominoplasty, where a great deal of the mortality is not acute and is attributable to deep vein thrombosis and pulmonary embolism, the improvements in mortality are less surgical technique related; rather, they focus on risk stratification of deep vein thrombosis and prophylactic medical management. The ability to identify those at higher risk for deep vein thrombosis/pulmonary embolism and to administer prophylaxis, first described by Caprini,⁴⁹ serves as the

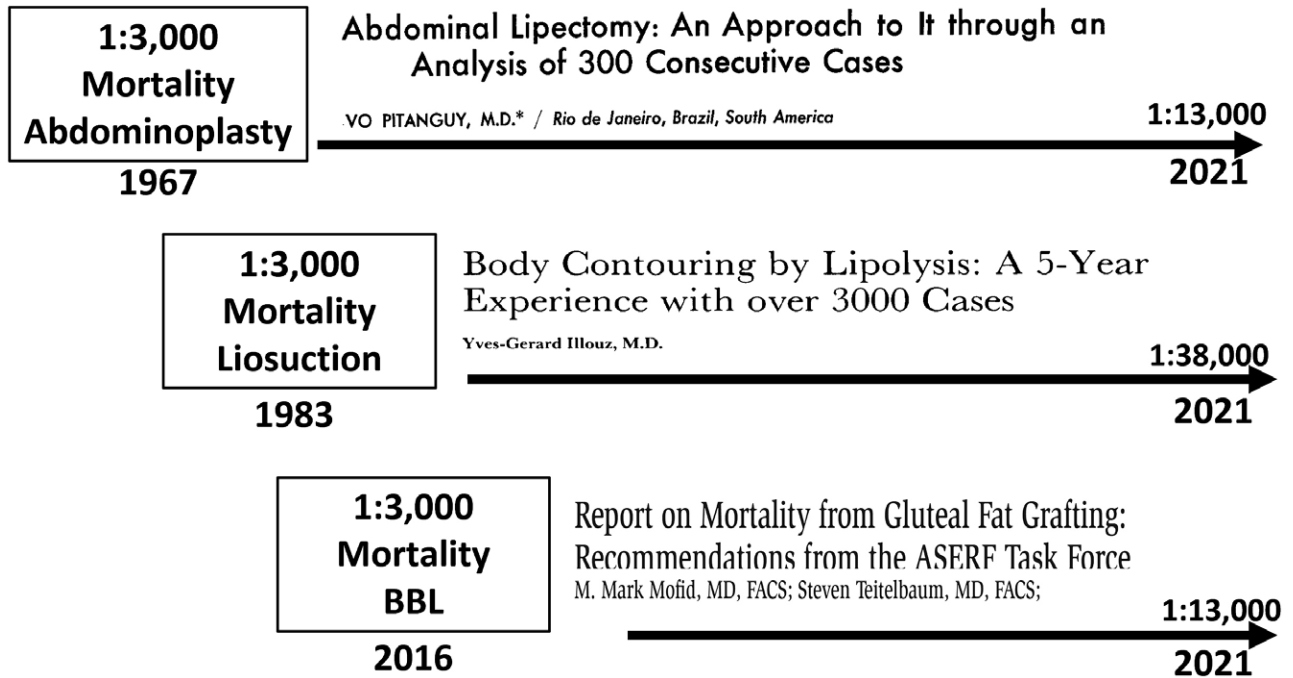


Fig. 3. Improvements in safety since introduction by reduction in mortality rates are demonstrated for three body contouring procedures. Note that there are different rates of reduction in mortality for the three procedures, with abdominoplasty showing the lowest annualized rate of safety improvement over time.

Table 2. Raw Reduction in Mortality versus Annualized Reduction in Mortality for Three Body Contouring Procedures

Procedure	Years in Use	Initial Mortality	2021 Mortality	Mortality Reduction (%)	Annualized Mortality Reduction Rate (%)
Abdominoplasty	54	1:3000	1:13,000	433	8
Liposuction	38	1:3000	1:38,000	1267	33
BBL*	20	1:3000	1:15,000	500	25

*Defines inception of any significant volume BBL procedures at 2001.

mainstay of mortality reduction. Finally, if we are to examine the three BBL mortality survey publications and take them at face value, there has been an apparent marked improvement in BBL mortality—in a very short period. This reduction in mortality is presumably attributable to improvements in instrumentation, the understanding of dynamic gluteal anatomy, and improvements in surgical

technique. Considering the established years of each body contouring procedure, along with each procedure’s corresponding mortality reduction, one can begin to see which procedure has the best potential to further reduce mortality (Table 2).

What is interesting when examining these three body contouring procedures and their evolution to increased safety is the slower rate of improvement for abdominoplasty mortality, compared with the mortality reduction of liposuction and BBL. Whereas surgical instrumentation and technical advances improve the mortality rates of liposuction and BBL, improvements in safety for abdominoplasty occur at a much slower rate. There is an inherent and unavoidable risk based on the circulatory system of the warm-blooded *Homo sapiens* that a patient will experience deep venous thrombosis and pulmonary embolism, and this risk can theoretically never be reduced to zero. Assuming that similar

Table 3. Forecasted Mortality with the BBL*

Procedure	2021 Mortality	Annual Mortality Reduction Rate (%)	Forecasted Mortality Based on Annual Reduction Rate				
			2022	2023	2024	2025	2026
BBL	1:15,000	25	1:18,750	1:23,438	1:29,297	1:?	1:45,776
Tummy tuck	1:13,000	8	1:14,043	1:15,170	1:16,387	1:?	1:19,123

*Using historical improvements in BBL safety, the BBL procedure is forecasted to exceed the safety of abdominoplasty with a mortality of less than one in 30,000 cases.

improvements in safety training, knowledge of anatomy, and practice guidelines evolve for BBL as they did for liposuction, and applying similar mortality reduction predictions to the BBL procedure over the next 3 to 5 years, one can forecast the mortality rate for this procedure to lie somewhere between one in 25,000 and one in 35,000 by 2025 (Table 3).

CONCLUSIONS

The 2017 ASERF survey study on BBL safety and mortality³ was highly cited and important because the BBL is a relatively new and innovative technique in plastic surgery; however, there may have been early assumptions leading to inconclusive data in its statistical analysis that might materially affect the published mortality rates.⁵⁰ Given the benefit of time and purposeful research by several surgeon authors since the early survey data were published, we are now presented with a better lens to view a more accurate safety profile of BBL surgery, including its place among other commonly performed aesthetic body contouring procedures.

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