

## Fat Embolism Mortality after Lipoharvest and Fat Injecting Buttocks: An Anatomical Study

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### Abstract

This viewpoint provides insight into a prevalent issue currently highlighted within the realm of aesthetic surgery, the mortality rate associated with the Brazilian Butt Lift. Following an anatomical study utilizing a fresh frozen cadaver, this viewpoint offers insight and provides recommendations to those performing Brazilian Butt Lifts in an attempt to decrease the mortality rate associated with this increasingly popular aesthetic surgical procedure.

**Keywords:** *Aesthetic surgery; Mortality rate; Butt lift; Anatomical study*

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### Background

The aesthetic surgery procedure with the highest risk of death is the Brazilian Butt Lift (BBL). It is estimated at 1 in 3000 [1-3] which is comparable to the incidence of BIA-ALCL, according to the Australian Society of Plastic Surgeons [4]. The BBL is a traumatic procedure involving extensive lipoharvest from the whole waist and other areas and the insertion of a very large amount of fat into each buttock. The procedure was championed by Tino Mendieta for many years with amazing results, apparent low risk and with significant survival of graft [5]. It has emboldened others to do the procedure particularly those using social media and following celebrity trends. The cause of death, in what are mostly young healthy women, is fat embolism (FE) in most cases, but there have been deaths from overwhelming sepsis and multi organ failure caused by progressive synergistic gangrene [1,6].

Fat embolism is actually very common in surgery and especially in orthopedics during bone reaming and in plastic surgical procedures especially the relatively innocuous, but common procedures such as liposuction [7,8]. Many cases of FE may be missed. Mild cases may present as post-operative confusion or drowsiness caused by hypoxia and may be misdiagnosed as over sedation, hypothermia or post anesthesia problems. Of course, a massive volume of intravenous fat will overwhelm the perfusing circulation and cause collapse and death. Fat embolism therefore has a spectrum of presentation from the very mild symptoms to the most severe clinical outcome depending upon the volume of the inoculated fat and the size of particulate fat. It is believed that the fat enters the bloodstream via ruptured or penetrated gluteal veins within the gluteus maximus. Small

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bore cannula directed upwards into the gluteus maximus via stab incisions within the gluteal crease, appear to be more likely incriminated.

At the Fourth Annual Meeting of the UK Association of Aesthetic Plastic Surgeons (UKAAPS, 2019) in London, fat embolism was discussed in detail. Dr. Cotrufo showed an excellent video demonstrating the presence of a strong fascial barrier between the subcutaneous, and gluteus maximus, but weak inter-fascicular connective tissue interface on the deeper surface of the muscle. This means that intramuscular injection of fat graft fills the muscle firstly then overfilling forces the fat graft into the sub-gluteal space. This was clearly demonstrated in a publication by Del Vecchio et al. at the end of 2018 [9]. They concluded that no fat should be injected into the intramuscular plane and that fat injection into the subcutaneous layer is safe. With large volume fat graft (measured in liters) into gluteus maximus, as was the situation in the reported deaths from the BBL, it is obvious that high pressures are needed to inject and fill. The expansion therefore forces fat into the sub gluteal space and hence the risk of avulsion damage to veins and consequently a direct venous inoculation with fat.

Connection into the superficial tissues can only be the result of traumatic multi-perforation by the cannula, or at the weak point where the perforators from superior and inferior gluteal arteries emerge into the subcutaneous tissue over the buttock. These are few and most volume expansion therefore is into the confined sub-gluteal space. If more circumferential volume is required laterally or inferiorly then fat has to also be inserted subcutaneously into the plane of fat below the lower border of gluteus maximus. This is the area forming and just above the gluteal fold at the level of the hip joint. According to Del Vecchio et al. this layer is safe.

## **Methods and Findings**

An ethics approved study at The School of Medicine, Anglia Ruskin University was undertaken with the intention of demonstrating and confirming the observations of Del Vecchio et al. and investigate possible lymphatic pathways that could contribute to fat embolism. Following extensive liposuction to the waist and abdomen in a thawed fresh cadaver, to mimic the effect of trauma of fat harvest during the BBL procedure, three liters of Intralipid, stained with 30 mms of methylene blue, was injected under direct vision solely into the gluteus maximus on the right buttock, and solely into the subcutaneous tissue of the left buttock. Intralipid injected into superficial left buttock tracks around into the anterior abdominal tissues, via a subtransversalis facial plane and into the inguinal lymph nodes (Figure 4 and Figure 5). This being the expected pathway for lymphatic drainage of the superficial buttock tissues.

We dissected the groin, para-aortic, intra-thoracic and superior mediastinal lymphatics within one hour of injecting dyed Intralipid into the right gluteus maximus and could not demonstrate any dyed fat in the deep lymphatic pathway of the sub-gluteal space, through para-iliac, para-aortic and the thoracic duct nor entering the circulation in the superior mediastinum. This was likely experimental error because of technical difficulties with thawing the central core tissues in the fresh frozen study cadaver.

## Interpretation

There are surgeons who are still advocates for Brazilian Butt lift and who continue to perform this procedure, however it remains a serious cause of mortality as a procedure and unless basic principles are applied, then young women will continue to die.



**Figure 1:** Cadaver prone. Injection of a small amount of Intralipid stained with methylene blue into the right surgically exposed gluteus maximus. The gluteus maximus expands and the dye enters the sub-gluteal space. Very little exudes through into the superficial tissues at the early stages of expansion.



**Figure 2:** Cadaver prone. Right gluteus maximus exposed and shown following injection of 1.4 litres of Intralipid stained with methylene blue injected into the gluteus maximus showing a massive projection in the anatomical confined sub-gluteal space. The dyed intralipid is now leaking superficially into the fat layer.



**Figure 3:** Cadaver prone and viewed from the left side. Left buttock following injection of 1.6 litres of Intralipid stained with methylene blue directly into the subcutaneous tissue. There is very little expansion in the vicinity of the gluteus maximus muscle and most of the expansion is laterally with a comparative flattening of buttock prominence. By comparison the exaggerated right buttock prominence is the result of intra-muscular injection of 1.4 litres of dyed Intralipid.



**Figure 4:** Cadaver supine. Dissection of the left anterior abdominal wall with left transversalis fascia showing Intralipid, stained with methylene blue, which has migrated into the deeper groin tissues from the sub-cutaneous buttock. The cadaver previously had extensive sub-cutaneous liposuction.



**Figure 5:** Lymph nodes taken from the left inguinal ring clearly showing the presence of blue dyed Intralipid.

Based on our cadaveric findings our recommendation to UK Surgeons continuing to fat graft buttocks are:

1. BBL should only be performed by experienced surgeons in facilities with access to high dependency or intensive care facilities.
2. There is a low threshold for suspecting pulmonary embolus up to 48 hours after fat grafting in patients with respiratory distress, altered levels of consciousness and petechial hemorrhages.
3. The volume of fat injected into the subcutaneous fat of each buttock should be limited to 300 mls and never under great tension. This number is arbitrary but is consistent to advice given for fat injection into breast to achieve best chance of graft survival. Larger volumes create tissue tensions and likely fat graft atrophy. Better to repeat the procedure than to force fat under pressure into the tissues.
4. It has to be accepted that to get the fuller projection at the mid/upper buttock that some patients desire, some fat has to be injected into the gluteus maximus otherwise a broader fat buttock is created. To guarantee otherwise to the patient

is misleading and actually impossible. This was clearly demonstrated in the cadaver study. The risks to the patient has to be explained during fully informed consent.

5. Fat should not be injected directly into the sub-gluteal space and therefore intramuscular injection should not be under great pressure. Fat will still preferentially dissipate into the sub-gluteal space because of the absence of a deep fascia to the muscle but the risk of avulsion of the gluteal space veins are reduced.
6. As few as possible cannula passages must be used in the muscle if it has to be penetrated at all and also in the subcutaneous fat layer. The injected fat still has the capability to enter groin lymphatics after lipoharvest to the waist as happens in the Brazilian Butt Lift. This was clearly shown in our study. An initial drawback technique must be employed before injecting fat into the buttock region. To prevent direct cannulation. This limits the risk of major vessel cannulation. A hematoma is a cause for concern.
7. The injecting cannula should never be directed towards the posterior iliac crest from the inferior gluteal crease. The chance of directly entering the sub-gluteal space via this approach directly is high.
8. The cannula should be large bore -at least 3 mm to avoid cannulation of the gluteal space gluteal vein complex.
9. Lateral or inferior fat graft to the buttock is anatomically always within subcutaneous tissue and therefore should not fall under the same risk restricted practice as applied to the BBL. Such fat is likely to be needed when buttock implants are inserted into intramuscular gluteus maximus pockets.
10. This surgery should not be carried out for purely cosmetic reasons by the inexperienced surgeon and patient outcomes must be carefully audited and reviewed. In all cases it is mandatory to carry out the procedure on fully informed and consented patients.

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