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META ANALYSIS

Autologous Fat Transfer for Gluteal Augmentation: A Meta-analysis Study

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Abstract

Background: **In 1969, Bartels et al. presented the initial description of gluteal augmentation using a breast Cronin prosthesis to treat buttock asymmetry. In recent decades, gluteal fat grafting has seen one of the fastest-growing rates of any cosmetic surgery technique.**

Objectives: **Analyze the published techniques of autologous fat transfer for Buttock augmentation (BBL), and compare different protocols to identify which technique is better in safety and effectiveness over the last 5 years, with demonstration of clinical cases.**

Subjects and methods: **This research was carried out by the Plastic Surgery and Burn Unit of the Al-Azhar University School of Medicine. The latest version of the PRISMA statement was adhered to, and both checklist and flow diagram are reported. This study attained all global research published by national and international authors up to the moment, which utilized the Autologous Fat Grafting for Gluteal Augmentation.**

Result: **From the initial pool of 800 items found, 150 were eliminated due to duplication. After examining the titles and abstracts of 200 papers, we made our final selections. We read all 59 papers in their entirety and checked their cited works for further resources. Fifteen articles were selected because they fulfilled our inclusion criteria.**

Conclusion: **In our meta-analysis, the technique proved its efficacy and safety as the overall satisfaction is excellent and most complications were minors with no mortality reported.**

Keywords: Autologous fat transfer, Gluteal augmentation, Meta-analysis

1. Introduction

Gluteal augmentation, most frequently recognized as a Brazilian butt lift (BBL), was popularized in the 1980s and '90s by Toledo and has since been carried out by others.[1]

It is essential that patients be carefully selected, evaluated and planned for prior to surgery.[2]

Understanding the interactions among the areas around the buttock may be more significant than the volume itself, making shape more relevant than volume and this is essential if we want to get a beautiful buttock contouring outcome.[3]

The 1st description of gluteal augmentation was informed by Bartels et al. in 1969 to breast Cronin prosthesis implantation to treat buttock asymmetry. The 1st reported example of cosmetic gluteal augmentation wasn't documented until four years later.[4]

In recent years, gluteal fat grafting has seen 1 of the fastest-growing rates of any plastic surgery technique.[5]

Lipofilling methods have grown more common due to the high rate of difficulties following silicone implant implantation. These issues include implant palpability, capsular contracture, movement, wound dehiscence, seroma and implant rotation, leakage, or rupture.[6]

There are both aesthetic and physical aspects to beautiful buttocks. For aesthetic purposes, it's ideal to have a well-projected gluteal area and a consistent line that curves gracefully from the waist to the

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knees when viewed from the front. The buttocks' bulk should be soft, with adequate skin elasticity, for a tactile aesthetic.[7]

Changing the standard for beauty to value fuller curves and a more prominent waist-to-hip and hip-to-lateral thigh ratio.[8]

Even as the procedure gains in popularity, worries about its side effects grow. Seroma or hematoma development, fat necrosis, sciatica caused by graft migration, severe infection, or deadly fat embolism are all possible outcomes of this operation.[9]

Despite shifts in what constitutes feminine attractiveness throughout time, the idealized shape and size of a woman's breasts and buttocks have stayed relatively stable. The earliest examples of human appreciation of beauty may be found in ancient art. Our fascination with reproduction throughout history is reflected in the voluptuous female forms shown in sculptures and prints.[10]

Our study is similar to a previous meta-analysis by Conde–Green et al. We performed a similar study again because there are different advances in the field of fat injection in the gluteal region developed in the last 5 years and different concern about the complications that warrant repeating the Meta-analysis.[11]

This work aimed to analyze the published techniques of autologous fat transfer for Buttock augmentation (BBL), and compare different protocols to identify which technique is better in safety and effectiveness over the last 5 years, with demonstration of clinical cases.

2. Methodology

The latest version of the PRISMA statement was adhered to, and both checklist and flow diagram are reported. This study attained all global research published by national and international authors up to the moment, which utilized the Autologous Fat Grafting for Gluteal Augmentation.

The 1^{ry} examination generated 800 articles, of which 150 duplicates were uninvolved. After first screening titles and abstracts, 200 papers were read in full. We reviewed all 59 papers in their entirety and checked their cited works for articles that may have evaded our first tests. 15 articles complied with our predetermined criteria and were involved in this investigation.

2.1. Search question

Which technique of autologous fat transfer (lipofilling) is better in safety and effectiveness for gluteal augmentation (BBL) in adult healthy female?

2.2. Inclusion criteria

Prospective and retrospective studies conducted on autologous fat transfer for gluteal augmentation (BBL) over the last 5 years.

2.3. Databases

We systematically searched PubMed, MEDLINE, Google Scholar, and Cochrane databases for relevant articles from inception over the last 5 years, until September 2022.

2.4. Study selection

Title and abstract were used to choose which studies to include and which to discard. Endnote by Clarivate and Mendeley by Scopus were used to catalog the titles. Systematic data extraction was performed by 2 distinct surgeons in accordance with PRISMA (preferred reporting items for systemic review and meta-analysis) criteria. A random-effects model meta-analysis was used to compile the findings.

2.5. Data analysis

MedCalc version 20.100 was used for the statistical analysis of the data. We used a 95 percent confidence interval (CI) and we regarded *P* values of less than or equal 0.05 to be significant. I2 (heterogeneity's observed variance) and Q (heterogeneity's total variance) were used to measure the degree of statistical heterogeneity present. Quantitative information was presented as a sum and a count of occurrences. There were only two possible outcomes (events or no events), thus the data were combined and presented as weighted proportions and risk ratios (RR) with 95% CIs.[12]

3. Results

Table 1.

3.1. Patient satisfaction

10 studies showed number of cases Satisfied with event rate 94.561% and significant heterogeneity among investigations *P* value < 0.0001 (Table 2).

3.2. Asymmetry

4 studies showed number of cases asymmetry with event rate 0.906% and significant heterogeneity between studies P value 0.0057 (Table 3).

Table 1. Meta-analysis for patient satisfaction.

Study	Total number	Event	Event rate (%) (Proportion)	95% CI of rate (%)
Vendramin FS et al., 2022[13]	146	141	96.575	92.189–98.879
Ashraf et al., 2021[14]	94	85	90.4	77.442–94.206
Elmelegy, 2021[15]	148	142	96	90.951–98.413
Kalaaji A et al., 2019[1]	44	39	88.636	75.442–96.206
Pane TA., 2019[16]	137	118	86.131	79.192–91.439
Chia CT et al., 2018[17]	34	34	100.00	89.718–100.0
Cansancao AL et al., 2018[18]	15	15	100.00	78.198–100.0
Khallaf ANM., 2017[19]	200	200	100.00	98.172–100.0
Abboud MH et al., 2015[20]	110	82	74.545	65.354–82.372
Rosique RG et al., 2015[21]	106	103	97.17	91.951–99.413
Total (fixed effects)			94.561	92.756–96.029
Total (random effects)			94.276	86.676–98.805
Test for heterogeneity				
Q	92.311			
DF	7			
Significance level	<0.0001*			
I^2 (inconsistency)	92.42%			
95% CI for I^2	87.42–95.43			

3.3. Patients wanted more liposuction

3 studies showed number of cases Wanted more liposuction with event rate 0.195% and significant heterogenicity between studies *P* value 0.0002 (Table 4).

Table 2. Meta-analysis for asymmetry.

Study	Total number	Event	Event rate (%) (Proportion)	95% CI of rate (%)
Vendramin FS et al., 2022[13]	146	5	3.425	1.121–7.811
Abboud M et al., 2021[22]	100	1	1.000	0.025–5.446
Cansancao AL et al., 2019[5]	35	2	5.714	0.700–19.157
Everett M et al., 2018[23]	916	4	0.437	0.119–1.114
Total (fixed effects)			0.906	0.451–1.620
Total (random effects)			2.088	0.379–5.125
Test for heterogeneity				
Q	12.5505			
DF	3			
Significance level	0.0057*			
I^2 (inconsistency)	76.10%			
95% CI for I^2	34.29–91.30			

Q: Total variance for heterogeneity.
I^2: Observed variance for heterogeneity.
CI, Confidence interval (LL, Lower limit; UL, Upper Limit).

Table 3. Meta-analysis for Wanted more liposuction.

Study	Total number	Event	Event rate (%) (Proportion)	95% CI of rate (%)
Pane TA., 2019[16]	137	5	3.65	1.195–8.311
Del Vecchio D et al., 2018[24]	2419	2	0.0827	0.010–0.298
Rosique RG et al., 2015[21]	106	1	0.943	0.024–5.144
Total (fixed effects)			0.195	0.065–0.447
Total (random effects)			1.231	0.0000024–4.869
Test for heterogeneity				
Q	17.2464			
DF	2			
Significance level	0.0002*			
I^2 (inconsistency)	88.40%			
95% CI for I^2	67.85–95.82			

3.4. Flat lower poles of buttocks

3 studies showed number of cases Flat lower poles with event rate 1.470% and insignificant heterogenicity between studies *P* value 0.4648 (Table 5).

3.5. Donor site skin blistering

3 studies showed number of cases Donor site skin blistering with event rate 3.514% and insignificant heterogenicity between studies *P* value 0.7801 (Table 6).

3.6. Buttock seroma

3 studies showed number of cases Buttock seroma with event rate 0.239% and significant heterogenicity between studies *P* value 0.0003.

Table 4. Meta-analysis for flat lower poles of buttocks.

Study	Total number	Event	Event rate (%) (Proportion)	95% CI of rate (%)
Pane TA., 2019[16]	137	3	2.19	0.454–6.266
Everett M et al., 2018[23]	916	11	1.201	0.601–2.139
Rosique RG et al., 2015[21]	106	2	1.887	0.229–6.650
Total (fixed effects)			1.470	0.860–2.341
Total (random effects)			1.470	0.859–2.242
Test for heterogeneity				
Q	1.5324			
DF	2			
Significance level	0.4648			
I^2 (inconsistency)	0.00%			
95% CI for I^2	0.00–95.62			

Table 5. Meta-analysis for donor site skin blistering.

Study	Total number	Event	Event rate (%) (Proportion)	95% CI of rate (%)
Kalaaji A et al., 2019[1]	44	2	4.545	0.555–15.473
Pane TA., 2019[16]	137	4	2.920	0.801–7.307
Abboud MH et al., 2015[20]	110	3	2.727	0.566–7.764
Total (fixed effects)			3.514	1.722–6.309
Total (random effects)			3.514	1.717–5.918
Test for heterogeneity				
Q	0.4966			
DF	2			
Significance level	0.7801			
I^2 (inconsistency)	0.0%			
95% CI for I^2	0.00–86.49			

4. Discussion

Fifteen clinical trials were included in this meta-analysis and systematic review, both national and international literatures, with a total 4496 female cases were included, all received autologous fat transfer for gluteal augmentation.

We found that a proper patient selection (healthys middle aged with average BMI), Mean age was 35.3 and Mean BMI was 26.55, with proper fat harvesting, fat processing, fat graft preparation and fat graft injection techniques gives an excellent satisfactory results with event rate 94.561%, (95% CI: 87.42%, 95.43%) and significant heterogeneity amongst research studies (P value < 0.0001).

4.1. Infiltration

In our analysis: Infiltration of the donor region using wet, super wert and klien formula techniques are utilized.

Table 6. Meta-analysis for Buttock seroma.

Study	Total number	Event	Event rate (%) (Proportion)	95% CI of rate (%)
Pane TA., 2019[16]	137	1	0.730	0.0185–4.000
Del Vecchio D et al., 2018[24]	2419	3	0.124	0.0256–0.362
Rosique RG et al., 2015[21]	106	5	4.717	1.549–10.665
Total (fixed effects)			0.239	0.0913–0.509
Total (random effects)			1.334	0.00433–4.974
Test for heterogeneity				
Q	16.5779			
DF	2			
Significance level	0.0003*			
I^2 (inconsistency)	87.94%			
95% CI for I^2	66.22–95.69			

Condé-Green et al., found that saline with adrenaline is the most prevalent, followed by Klein and Ringer lactate solutions with adrenaline.[11]

4.2. Liposuction

In our analysis: 3 mm and 4 mm diameter cannulas were the most used in liposuction. **Cansancao** et al.'s study of Brazilian plastic surgeons found that they most frequently used liposuction equipment with a four mm cannula.[18]

4.3. Fat preparation

Many different methods of fat preparation are discussed in the literature. Decanting, filtration, washing as well centrifugation are the most typical ways for preparing fat grafts.[25]

In our analysis: only decantaion and washing with saline were used for fat preparation.

Clinical trials have shown that centrifugation, as opposed to gravity separation, yields better results in some cases.[26]

4.4. Donor regions

In our study, individuals came from a wide variety of donor areas. Several people required more than one donor location, with the waist and the lateral portion of the thighs being the most common, in agreement with the literature[21,27]

4.5. Fat grafting

In our analysis: The most common tools for fat grafting were four millimeters blunt-tipped cannulas and sixty milliliters syringes, either manually or connected to power assisted devices. One article used ultrasound for guiding of plane of injection. One article used 20 ml syringe and one used roller pump device.

Our meta-analysis is somewhat supported by data from Condé-Green et al. who reported that only 15 percent of procedures employed 4 mm cannula, 54.5 percent were conducted using 60 mL syringes and just 3 papers reported the use of cannula with 3 holes. In comparison to the six publications reviewed by Condé-Green et al. who described the injection ranged amongst 0.3 and 20 ml for each cannula passage, our articles inject around 15 and 50 ml of fat every cannula pass.[11]

In our analysis: the most common access for lipo-injection was through intergluteal and subgluteal incisions, three articles used lateral supragluteal incisions.

In 2022, BAAPS Gluteal Fat Grafting Safety Review -and Recommendations: use inter gluteal access is better than subgluteal to avoid entry to sciatic foramina.[28]

In our analysis: the only plane used for lipofilling was subcutaneous plane either superfacial or deep subcutaneous.

International literature recommended avoiding injecting fat into intramuscular and sub-muscular planes.[29]

4.6. Complications

In our analysis: mean complication rate was 2.72% from gluteal augmentation with fat transfer, (P value = 0.05). Majority were minor complications, no major complication reported except one case of postoperative DVT, which hospitalized and fully recovered. All articles reported that they followed international literature of staying safe during lipofilling of gluteal region through subcutaneous plane and avoiding deep muscular plane for fat injection, which could prevent fatal complications resulting from major gluteal vessels injury, such as fat embolism and fat embolism syndrome.

A meta-analysis by Condé-Green et al. The authors conducted a comprehensive review of the literature on gluteal fat augmentation procedures and singled out the methods that raised ethical questions. Patient satisfaction was high following injection of a mean of 400 mL of decanted lipoaspirate into each gluteal area, as shown by a meta-analysis of 17 case series and 2 retrospective investigations including 4105 participants. The data demonstrated no statistically significant association amongst the injection planes and the mean complication rate of seven percent.[11] While Condé-Green et al. found fat grafting to be a 'effective and predictable way to remodel gluteal regions,' they also noted that avoiding fat embolism by protecting gluteal vessels was among the procedure's potential dangers. They believed that improved results might be achieved via systematic examination of the fat grafting process and case reporting in a central registry.[11]

Whether fat is inserted into the deep or superficial muscle, given enough volume, it won't stay in the muscle as well as will spill deep into the submuscular space, as was concluded in an article by Del Vecchio et al. titled Clinical Implications of Gluteal Fat Graft Migration: A Dynamic Anatomical Research. The direction in which a cannula is inserted has been linked in some accounts to an increased likelihood of success. Some have argued that injecting through the natal cleft technique (from above, medial) is securer than through the inferior gluteal crease incision (from below).[24]

4.7. Conclusion

Gluteal augmentation with autologous fat transfer is considered a win–win situation, as we can do both liposuction to different body areas and use their extracted fat for gluteal lipofilling simultaneously. In our meta-analysis, the technique proved its efficacy and safety as the overall satisfaction is excellent and most complications were minors with no mortality reported.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article.

Conflicts of interest

The authors declared that there were NO conflicts of Interest.

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