

REVIEW ARTICLE



Glans penis augmentation: when, how, and why?

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The growing demand for glans penis augmentation (GPA) makes it a hot topic in the field of andrological surgery, albeit still widely debated. The lack of high supporting evidence and its technically challenging aspects are the main concerns. The aim of this study was to review the current literature about GPA in order to provide an easy and comprehensive overview of the topic. GPA is suitable for managing both cosmetic and functional issues. Counseling should be the cornerstone of the decision-making process. A thorough understanding of the glans anatomy and treatment strategies remain essential to safely and effectively address the patient's needs. GPA can be performed using injectable fillers or surgical grafting. Glans-shaft penis asymmetries, small glans size, and loss of glans tumescence can be managed by both injectable fillers and surgery. On the other hand, patients with lifelong premature ejaculation can mainly benefit from using injectable fillers. Currently, available studies show promising results but are limited by small sample's size and non-randomized design. Furthermore, treatment-related complications are poorly reported. The long-term efficacy and safety profiles of GPA techniques should be further investigated.

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INTRODUCTION

Glans penis augmentation (GPA) is a topic as intriguing as it is still debated. The lack of high supporting evidence and its technically challenging aspects seem to be the main limits to the widespread adoption of GPA. However, the growing demand for GPA makes it a "hot topic" in the field of andrological surgery.

A thorough understanding of the glans anatomy, with its uniqueness and differences from the penis shaft, is the basis for safe and effective management of the patient's needs. On the other hand, it is advisable not to address patients' requests indiscriminately, but to screen cases worthy of treatment through in-depth counseling. Here more than elsewhere it is suitable to share with patients the supporting literature, the range of management options available, advantages and disadvantages, as well as the expected results and possible complications.

GPA means the volumetric increase of the glans size, with a medical or surgical approach [1]. It is suitable to manage both cosmetic and functional issues. GPA using injectable filler was the first technique tested and described. The first report dates back to 2003 and was then followed by several case series and a randomized controlled cross-over study [2–7]. Only a decade later, in 2012, Shaer published the pilot study of the surgical technique that bears his name, introducing the concept of GPA by grafting [8].

The aim of this study was to review the literature about GPA in order to provide an easy and comprehensive overview of the topic.

GLANS PENIS ANATOMY

The glans form the distal end of the penis. Historically considered as the anterior bulge of the corpus spongiosum of the urethra, it

covers the tip of the corpora cavernosa. The conical shape of the glans is functional to its role in sexual intercourse, which consists of promoting penetration [9].

Under normal conditions, the glans are larger in diameter than the shaft of the penis. The corona of the glans penis defines the circular relief on the edge between the glans and the shaft of the penis, with the glans protruding over the shaft [9].

The arterial vascularization is supported by the internal pudendal artery, via the dorsal artery of the penis [10, 11]. The structure of the arterial tree is manifestly terminal, an aspect not to be underestimated during invasive maneuvers on the glans. The venous system is ensured by the tributary branches of the deep dorsal vein, which after passing the root of the penis disappears into the dorsal vascular plexus of Santorini [10, 11]. The glans mucosa has a great wealth of sensitive nerve branches [9]. Underneath a stratified squamous epithelium, the dermis is made up of a dense layer of connective tissue as in typical skin. The innervation comes mainly from the branches of the genitofemoral nerve and the internal pudendal nerve and continues as the dorsal nerve of the penis. Nerve endings are mostly corpuscular.

SEARCH STRATEGY AND PAPER SELECTION

The Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE (via the PubMed interface), and Embase databases were searched for published studies. The following keywords were used: "penile glans augmentation" and "penis glans augmentation". Surgical and medical GPA management strategies were evaluated. The search was performed in April 2021 and was limited to English-language publications. Among all, eight original

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papers focusing on human GPA were included in the current study. Evidence was synthesized in a narrative framework.

CLINICAL INDICATIONS TO GPA

The choice to perform a GPA approach can be shared with the patient in order to address a spectrum of clinical conditions, from purely esthetic, but no less worthy reasons, to otherwise functional ones. The need for in-depth counseling remains pivotal, which, if properly addressed, can be decisive in many cases [12]. Sexual problems intimately affect the psychological sphere of patients and cause profound stress, in a vicious circle that is difficult to overcome.

Among the cosmetic reasons that lead the patient to medical observation, the subjective dimensional perception distorted by conditions of clear glans-shaft penis asymmetry should be distinguished. The internet and social media have significantly influenced mass culture by offering wrong models and stereotypes to imitate. Consequently, it is an ethical need to dissuade clinically inappropriate requests. On the other hand, medical or surgical correction is appropriate for the management of various unsightly conditions. Asymmetries between the glans and the shaft of the penis can result from penile enlargement procedures or penile prosthesis implantation. In prosthetic surgery for the treatment of erectile dysfunction or penile curvatures, glans management remains an unmet medical need [13]. The lack of firmness and the relatively smaller size are a source of functional and esthetic dissatisfaction for patients. The functional issue in these cases is the difficult promotion of penetrative sexual intercourse. Other situations worthy of correction are congenital asymmetry and malformative conditions. Moreover, acquired micropenis can result from infections and trauma or present an iatrogenic etiology [1].

A clinical indication to GPA by fillers is the management of patients with premature ejaculation (PE) [12]. However, its indication remains still controversial. PE is the most common male sexual complaint and its prevalence is estimated to be between 20% and 30% of the male population, with millions of men affected worldwide [14]. PE has a significantly negative impact on the quality of life of patients, with important repercussions on the couple balance and the well-being of the partners [15, 16]. The European Association of Urology (EAU) guidelines recommend, before starting any treatment strategy, to define the subtype of PE and discuss the patient's expectations thoroughly [17]. Pharmacotherapy must be considered as the first-line management option for patients with lifelong PE. The main limitation of pharmacotherapy is the relapse after withdrawal of medication. Decreasing glans sensitivity by injecting hyaluronic acid (HA) into the dermis of the glans was initially proposed by Korean researchers in 2004, and since then has gained popularity mainly in Asian countries [3]. However, GPA using fillers needs more safety studies before it can be recommended for the management of patients with PE by the leading International Scientific Societies.

GPA USING AN INJECTABLE FILLER

In 2003, the first use of HA as an injectable filler for GPA was described [2]. Since then, several clinical series have been published, mainly focusing on the management of patients with PE. However, the level of evidence achieved does not yet support recommendations on the proper use of this approach. Long-term efficacy and safety issues remain poorly addressed in the current literature.

The ideal filling substance for soft-tissue augmentation should be biocompatible, non-antigenic, non-pyrogenic, non-inflammatory, non-toxic, easy to use, stable after injection, non-migratory, long-lasting but resorbable, natural-looking, and not too

expansive [2]. The HA, a ubiquitous component of connective tissue, responds well to these needs. The increased tissue longevity is one of its main advantages. In a 5-year follow-up study, the residual volume after GPA using HA gel injection decreased by 15% of maximal glandular circumference [4]. Two factors contribute to extensive implant longevity: slow tissue digestion and isovolumetric degradation. The stability of the HA through cross-linkage significantly reduces tissue digestion, without negatively impacting biocompatibility. Isovolumetric degradation means the maintenance of a balance between gel and water over time. Furthermore, in cases of volume loss, integration through reinjection is a feasible solution.

GPA by injectable fillers can be performed under local anesthesia. Topical application of Emla (lidocaine and prilocaine) is commonly used for this purpose. Several injection techniques have been described, but none have been proven to be better than the others (Fig. 1). To develop a simple and effective injection technique, *the linear threading approach* was initially introduced (Fig. 1a). Despite its ease of use and more uniform distribution of the injected material, this technique requires more punctures with an increased risk of bleeding and leaking from injection sites. *The fan technique* (Fig. 1b), on the other hand, allows fewer needle punctures. In both techniques, the injection needle was indwelled subcutaneously at one-third of the distance proximally from the tip of the glans to the coronal sulcus. *The three-circle technique* involves dividing the glans surface into three circular areas at a distance of 1 cm from each other (Fig. 1c). The circles are then divided into quadrants, each of which needs to be filled with the injected material. Finally, *the circular two-level technique* was described (Fig. 1d). The limit between the two circular levels passes through the mid-way between the corona of the glans and the urethral meatus. The approach involves more injections at the proximal (coronal) level than in the distal circle. Regardless of the technique used, to avoid overfilling, the appropriate injection volume is approximately 2 ml [18].

Currently available studies showed that HA injection was associated with a subjective clinical benefit in PE patients, with a significant increase of intravaginal ejaculation latency time (IELT)

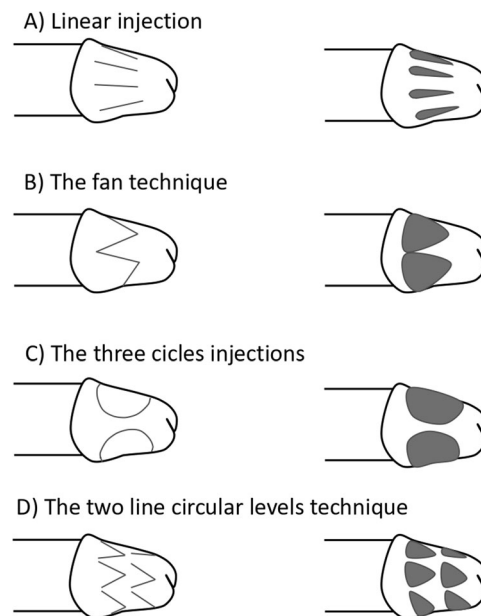


Fig. 1 Different injection techniques. Injection techniques: (a) the linear threading, (b) the fan, (c) the three-circle, (d) the circular two-level.

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Table 1. Studies showing IELT change following glans HA injection in patients with PE at different follow-up intervals.

| First Author, year | IELT (s) [range] | | | | | |
|--------------------|------------------|-----------|------------------|-----------------|-------------------|-------------------|
| | Baseline | 1 week | 1 month | 3 months | 6 months | 5 years |
| Kim 2004 [2] | 96.5 [35–210] | – | – | – | 281.9 [250–420] * | – |
| Kwak 2008 [3] | 84.2 [45–170] | – | – | – | 376.7 [270–470] * | 352.2 [220–410] * |
| Abdollah 2011 [4] | 127.2 [30–300] | – | 462.6 [30–1800]* | 319 [30–1200] * | – | – |
| Littara 2013 [5] | 88.34 | – | – | – | 293.14 * | – |
| Alahwany 2019 [6] | 30 | 40 [0–80] | 73 [0–240]* | – | – | – |

IELT intravaginal ejaculation latency time, HA hyaluronic acid, PE premature ejaculation.

* $p < 0.05$ versus baseline.

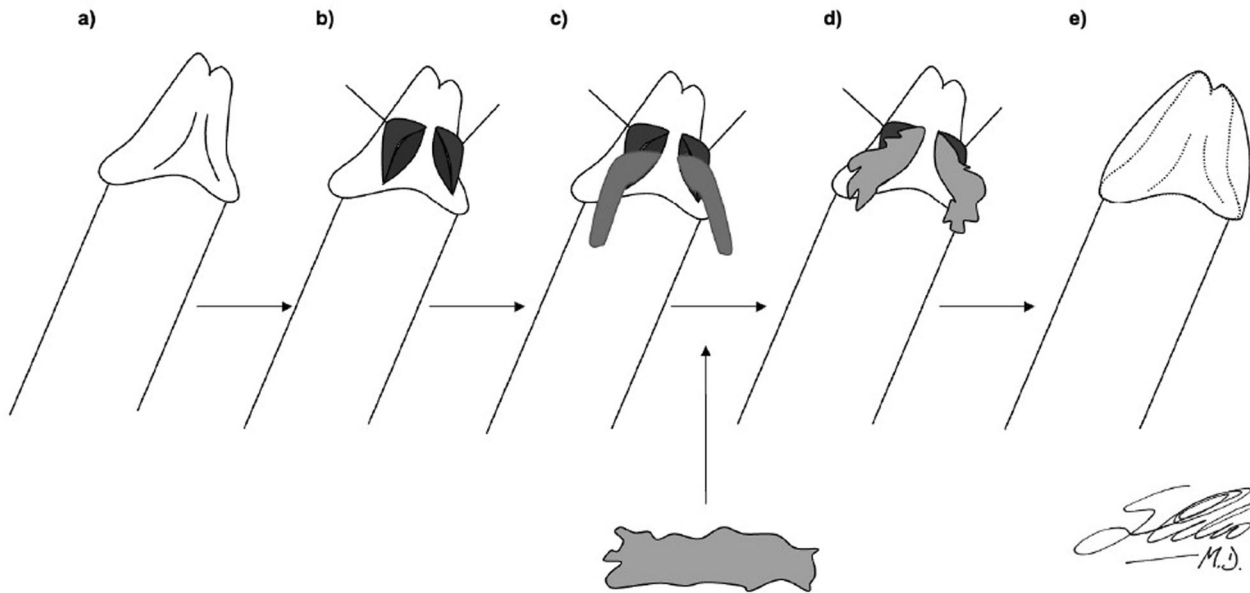


Fig. 2 Shaeer glans augmentation technique. Surgical steps: (a) incision, (b) glans flaps dissection, (c) periurethral plane, (d) dermofat graft insertion, (e) flaps closure.

from 2.43 to 4.46-fold (Table 1) [12]. Furthermore, this improvement could persist over time (up to 5 years) [4]. The reduced glans sensation threshold and the positive impact of the enlarged glans on self-esteem and self-confidence may help explain the long-term efficacy of the treatment.

The popularity of fillers correlates with ease of use, promising results, and low complication rates [18]. The use of non-permanent fillers has the advantage of offering a totally reversible approach, without negatively affecting other domains of sexual function. Moreover, the treatment can be safely repeated, by re-injection, for clinical needs. A limitation of GPA by filler is that the implant injection into the dermal space could be technically demanding.

Filler properties, improper injection techniques, and inflammation are the three main sources of filler-related complications [1]. However, complications remain poorly addressed in the current literature.

GPA BY GRAFTING

Since the introduction of GPA by injectable fillers, other different approaches have been studied. The main limitations of the injection management that it was intended to overcome were the implant longevity and costs. On the other hand, the safety of the new approaches had to cope with the low complication rate of injection management, as shown by the scientific literature [1]. Indirect GPA refers to the implantation of dermofat grafts or scaffolds between the corpus spongiosum and the distal tip of the corpora cavernosa.

In 2012, Shaeer published the pilot study of the surgical technique that bears his name [8]. The “Shaeer’s glans augmentation” technique is schematically illustrated in Fig. 2. Two longitudinal incisions are made along the ventral aspect of the coronal sulcus, one on each side of the frenulum (Fig. 2a); lateral glans flap is dissected (Fig. 2b); the urethra is circumvented (Fig. 2c); a dermofat graft is inserted into the periurethral plane developed (Fig. 2d); and the flaps are closed by simple absorbable sutures (Fig. 2e). The pilot study involved 10 patients who reported promising results with a 16.6% increase in maximum glans circumference, volume retention at the 1-year follow-up, glans sensitivity, and engorgement preservation, and no major adverse effects. Moreover, the self-reported impression of augmented volume was high and well maintained over the follow-up period.

The use of indirect GPA is currently supported by poor evidence and more safety studies are needed. The risk of urethral injury, loss of ischemic tissue, and graft contraction/necrosis should not be underestimated. To date, the invasiveness of surgical management and the lack of knowledge of long-term efficacy remain the main limitations to the spread of indirect GPA.

GPA: WHEN, HOW, AND WHY?

The main challenge faced by specialists in the field is the proper orientation to GPA. Although the supporting literature needs more evidence, the experiences of surgeons who have dedicated

themselves to GPA over time are promising. The careful study of the patient remains central. An accurate medical history that aims to identify all the aspects, even the most hidden, complained of by the patient must be the fundamental starting point of the medical consultation. Sharing expectations without neglecting potential risks is strongly recommended. Given the uniqueness of the field, the discussion with the patient can be implemented through the use of images.

The choice of management strategy for GPA must consider patient, surgeon, and logistics aspects. The patient fully informed of the available options should make his decisions independently and consciously. On the other hand, the surgeon must be properly trained for the proposed approaches and able to cope with possible complications. For logistical aspects, the need for a greater infrastructure to perform grafting techniques compared to filler injections must be considered.

GPA is currently a hot topic in the field of andrological surgery. Keeping up with the times is the key to meeting patients' expectations. Research, study, and dedication are the tools to satisfy the significant growth in patient demand.

CONCLUSIONS

The growing demand for GPA makes it a hot topic in the field of andrological surgery, albeit still widely debated. Counseling should be the cornerstone of the decision-making process. GPA is suitable for managing both cosmetic and functional issues and can be performed using injectable fillers or surgical grafting. Glans-shaft penis asymmetries, small glans size, and loss of glans tumescence can be managed by both injectable fillers and surgery. Patients with lifelong PE, on the other hand, can mainly benefit from using injectable fillers. Currently, available studies show promising results but are limited by small samples size and non-randomized designs. The long-term efficacy and safety profiles of GPA techniques should be further investigated.

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AUTHOR CONTRIBUTIONS

Gianluigi Califano was responsible for writing the report, conducting the search, screening potentially eligible studies, extracting and analyzing data, and interpreting results. Davide Arcaniolo was responsible for editing the report and provided feedback on the report. Claudia Collà Ruvolo was responsible for writing and editing the report, analyzing data, and interpreting results. Celeste Manfredi was responsible for extracting and analyzing data. Francesco Smarrazzo was responsible for screening potentially eligible studies, updating reference lists. Simone Cilio was responsible for screening potentially eligible studies, updating reference lists. Paolo Verze was responsible for designing the review protocol, provided feedback on the report.

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COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

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