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RESEARCH ARTICLE

Inflatable Extracorporeal Versus Solid Silicone Penile Implants for Cosmetic Enlargement and Partial Erectile Dysfunction: A Multicenter Comparative Study

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ABSTRACT

Objective: To compare clinical outcomes, safety profiles, and patient satisfaction between solid silicone implants (Peniflex) and a novel inflatable extracorporeal implant (Penogrande) for penile enlargement, including an analysis of outcomes in patients with partial erectile dysfunction.

Methods: Between 2017 and 2025, 255 patients underwent penile enlargement surgery across seven international centers (Ukraine, Poland, Turkey, Mexico, Oman, United Arab Emirates). Peniflex solid silicone implants were placed in 232 patients; Penogrande inflatable extracorporeal implants were placed in 23 patients. All patients underwent concomitant ligamentotomy for length enhancement and followed a standardized 2-month postoperative stretching protocol. Outcomes were assessed at 2 and 12 months and included dimensional changes, patient satisfaction, sexual function improvement (International Index of Erectile Function-5), and complications.

Results: Peniflex implantation resulted in average length gain of 1.47 ± 0.52 cm and girth gain of 4.9 ± 0.61 cm, with 90.1% patient satisfaction. Complications included seroma requiring puncture (37.5%), implant displacement (2.15%), implant prolapse (0.43%), and decreased erection (0.43%). Penogrande implantation showed larger dimensional outcomes: length gain of 3.11 ± 0.83 cm and girth gain upon inflation of 6.7 ± 0.97 cm ($P < 0.01$ vs. Peniflex). Patient satisfaction reached 91.3% for sexual function improvement, with all patients reporting increased self-confidence. Among patients with partial erectile dysfunction (n = 14), 85.7% reported improved erectile rigidity during implant use, and 78.6% reduced or eliminated phosphodiesterase type 5 inhibitor use. Penogrande complications included prolonged seroma requiring three punctures and antibiotics (4.3%), infected hematoma requiring surgical drainage (4.3%), and fibrotic scar impairing pump function requiring surgical revision (4.3%). No Penogrande implants required removal.

Conclusion: Both solid silicone implants and the inflatable extracorporeal Penogrande implant achieve high patient satisfaction and meaningful penile enlargement. Penogrande offers greater dimensional gains and unique dual functionality for patients with partial erectile dysfunction, providing both cosmetic enhancement and structural support that improves erectile rigidity. However, the inflatable design introduces unique complications including infectious and fibrotic events that require careful patient selection and counseling.

Keywords: penile enlargement, inflatable penile implant, solid silicone implant, Peniflex, Penogrande, Himplant, erectile dysfunction, veno-occlusive erectile dysfunction, complications.

Introduction

Male dissatisfaction with penile size affects an estimated 30% to 45% of men and represents the most common manifestation of penile dysmorphophobia[1,2]. This dissatisfaction can profoundly impact self-esteem, intimate relationships, and overall quality of life[3]. The demand for penile enhancement procedures has grown substantially, driven by both aesthetic concerns and the desire for improved sexual confidence[4].

Surgical approaches to penile enlargement have included ligament release for length enhancement[5], fat grafting, dermal fillers, and various implantable devices[6]. Each approach carries inherent limitations: fat grafting suffers from unpredictable absorption rates[7]; fillers require maintenance and carry risks of uneven results[8]; and early solid implants were associated with complications including displacement, seroma formation, and unnatural appearance[9].

The evolution of penile implants has followed two parallel tracks: solid silicone implants designed primarily for permanent girth enhancement (exemplified by Peniflex and the US Food and Drug Administration-cleared Himplant, formerly Penuma)[10,11] and inflatable devices traditionally reserved for erectile dysfunction treatment[12]. Solid silicone implants have demonstrated significant efficacy, with studies reporting girth increases of 56.7% and high long-term satisfaction rates of 81% at 2 to 6 years of follow-up[13]. However, these devices are purely cosmetic and do not address erectile function.

A critical gap exists for devices that simultaneously address cosmetic concerns and functional erectile insufficiency—particularly relevant given that veno-occlusive erectile dysfunction affects up to 30% of young and middle-aged men presenting with erectile concerns[14]. Traditional venous surgery for veno-occlusive erectile dysfunction has disappointing long-term success rates below 40%[15], while standard three-piece inflatable prostheses, though highly effective for severe erectile dysfunction, represent a more invasive intervention typically reserved for refractory cases[16].

The Penogrande implant was originally developed in Ukraine for a unique clinical need: preparing soldiers with genital injuries for reconstructive surgery by providing temporary extension[17]. However, an unexpected finding emerged—patients were so satisfied with the device's performance during sexual activity that many elected to retain it permanently rather than proceed with reconstruction. This serendipitous observation led to the redesign of Penogrande as a dual-purpose device for both cosmetic enhancement and erectile support.

This study presents the first comprehensive comparison between solid silicone implants (Peniflex) and the novel inflatable extracorporeal Penogrande implant, with special attention to the advantages of inflatable technology for patients with partial erectile dysfunction, while providing updated data on the evolving complication profile of this new device.

Materials and Methods

STUDY DESIGN AND PATIENT POPULATION

This multicenter retrospective comparative study analyzed outcomes of penile enlargement surgeries performed between January 2017 and February 2026 across seven centers in Ukraine, Poland, Turkey, Mexico, Oman, and the United Arab Emirates. A total of 255 patients were included: 232 who underwent Peniflex solid silicone implantation and 23 who received the Penogrande inflatable extracorporeal implant.

INCLUSION CRITERIA:

- Male patients aged 21 to 65 years
- Primary complaint of inadequate penile size (length and/or girth)
- Stable relationship or consistent sexual partner for 6 months or longer
- Minimum 12-month follow-up availability
- Circumcised penis, should be done at least 2 months prior implantation (required to reduce post op swelling, prolabation and infection risk, as the surgical technique relies on a predictable skin envelope without foreskin interference)
- For the Penogrande group only: willingness to consider device explantation if not satisfied

EXCLUSION CRITERIA:

- Active genitourinary infection
- Untreated psychiatric conditions including body dysmorphic disorder
- Previous penile surgery (except circumcision) with fibrotic changes, lipofilling, presence of synthetic fillers

- Peyronie disease with curvature greater than 30°
- Severe erectile dysfunction (International Index of Erectile Function-5 score <11) in patients not desiring a prosthesis

Within the Penogrande group, a subgroup of 14 patients (60.9%) had pre-existing partial erectile dysfunction, defined as International Index of Erectile Function-5 scores between 15 and 19, with 8 of these patients having documented veno-occlusive erectile dysfunction by penile Doppler ultrasound (end-diastolic velocity >5 cm/s, resistive index <0.8).

IMPLANT CHARACTERISTICS

Peniflex (solid silicone implant): Developed in 2015 by I. Aguilar, Peniflex is a solid silicone matrix surgically placed beneath the penile skin to provide permanent girth enhancement.10 It is designed to be flexible and compatible with penile anatomy, covering the dorsal and lateral aspects while preserving the ventral urethral area. The implant is available in multiple sizes and is intended for patients seeking permanent, irreversible enlargement. Similar devices in this category include Himplant (formerly Penuma), which has received US Food and Drug Administration clearance for cosmetic penile enhancement[11].

Penogrande (inflatable extracorporeal implant): Originally designed in Ukraine in 2024 for military reconstructive preparation, Penogrande is an inflatable extracorporeal device that surrounds the penile shaft and can be inflated to provide both girth expansion and structural rigidity[17]. Unlike traditional three-piece inflatable prostheses that replace the corpora cavernosa[18], Penogrande is placed externally to the tunica albuginea and does not interfere with native erectile tissue. The device connects to a scrotal pump mechanism similar to traditional inflatable prostheses but is designed for patients who retain some native erectile capacity.

SURGICAL TECHNIQUES

All patients underwent a combined procedure including: (1) ligamentotomy (suspensory ligament release) for length enhancement, and (2) implant placement according to manufacturer specifications.

Peniflex implantation: As previously described[19], the procedure is performed under general or spinal anesthesia through a suprapubic incision. The appropriately sized silicone implant is fixed to the penis slightly behind the coronal sulcus, positioned to cover dorsal and lateral aspects while avoiding the urethra.

Penogrande implantation: Through a penoscrotal incision, the extracorporeal space is developed superficial to Buck fascia. The implant is positioned to encircle the penile shaft, with the pump mechanism placed in the scrotum analogous to traditional inflatable prostheses. The reservoir, when used, is placed in the prevesical space. The device remains deflated during healing, with activation beginning at 2 to 4 weeks postoperatively, sexual activity restores in 6 weeks.

POSTOPERATIVE PROTOCOL

All patients were instructed to follow a standardized 2-month stretching protocol postoperatively to optimize length gains. Follow-up assessments were conducted at 2 months (early term) and 12 months (long-term).

OUTCOME MEASURES

Primary outcomes:

- Dimensional changes: stretched penile length and circumference (flaccid and erect/inflated) measured by standardized technique
- Patient satisfaction: 5-point Likert scale for overall result, sexual life improvement, and self-confidence enhancement

Secondary outcomes:

- Complications: seroma, displacement, prolapse, infection, hematoma, fibrosis, pain, erectile function changes
- For the Penogrande group: erectile function assessment (International Index of Erectile Function-5) pre-implantation and post-implantation
- Phosphodiesterase type 5 inhibitor utilization changes

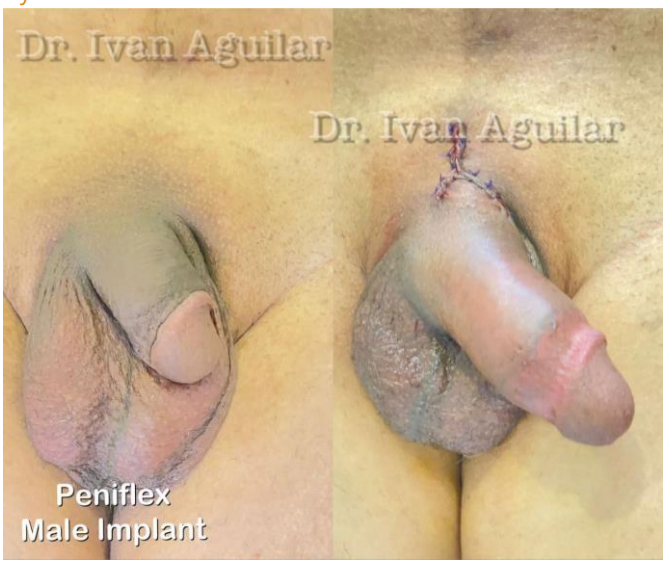

Figure 1. Peniflex implant

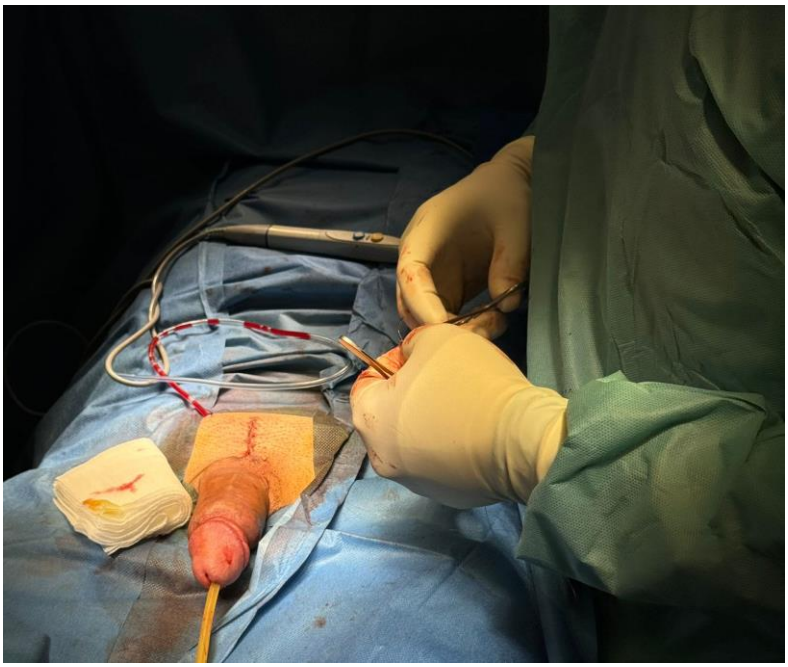

Figure 2. Patient after peniflex implantation

Figure 3. Measurments of penile circumference before a and after peniflex implantation

STATISTICAL ANALYSIS

Data were analyzed using SPSS version 26.0 (IBM, Armonk, New York). Continuous variables were expressed as mean ± standard deviation and compared using independent t tests. Categorical variables were compared using χ^2 or Fisher exact tests. A P value <0.05 was considered statistically significant.

Results

BASELINE CHARACTERISTICS

The Peniflex group (n = 232) had a mean age of 38.4 ± 6.2 years, while the Penogrande group (n = 23) had a mean age of 41.7 ± 5.8 years (P = 0.12). Baseline penile dimensions were comparable between groups: mean stretched length was 11.2 ± 1.3 cm in the Peniflex group vs. 10.9 ± 1.4 cm in the Penogrande group (P = 0.34); mean mid-shaft circumference was 9.8 ± 0.9 cm vs. 9.6 ± 1.0 cm, respectively (P = 0.41).

In the Penogrande group, 14 patients (60.9%) had pre-existing partial erectile dysfunction, including 8 with confirmed veno-occlusive erectile dysfunction. Mean baseline International Index of Erectile Function-5 score in this subgroup was 17.2 ± 2.1.

DIMENSIONAL OUTCOMES

Penogrande demonstrated significantly greater length gain (3.11 ± 0.83 cm vs. 1.47 ± 0.52 cm, P < 0.001) and inflated girth gain (6.7 ± 0.97 cm vs. 4.9 ± 0.61 cm, P < 0.001) compared with Peniflex. The difference in flaccid girth gain did not reach statistical significance (4.2 ± 0.7 cm vs. 3.8 ± 0.5 cm, P = 0.08).

Table 1. Dimensional Changes Following Implantation

Parameter	Peniflex (n=232)	Penogrande (n=23)	p-value
Length gain (cm)	1.47 ± 0.52	3.11 ± 0.83	<0.001
Girth gain – flaccid (cm)	3.8 ± 0.5	4.2 ± 0.7	0.08
Girth gain – erect/inflated (cm)	4.9 ± 0.61*	6.7 ± 0.97**	<0.001

*Erect measurement for Peniflex; **Inflated measurement for Penogrande

PATIENT SATISFACTION AND QUALITY OF LIFE OUTCOMES

Both implants achieved high satisfaction rates exceeding 90%. Penogrande showed numerically higher rates for sexual life improvement (91.3% vs. 81.4%) and self-confidence (100% vs. 95.2%), though these differences did not reach statistical significance given the smaller Penogrande cohort.

Table 2. Patient-Reported Outcomes at 12 Months

Outcome	Peniflex (n=232)	Penogrande (n=23)	p-value
Satisfied with result	211 (90.1%)	21 (91.3%)	0.89
Improved sexual life I	189 (81.4%)	21 (91.3%)	0.21
Increased self-confidence	221 (95.2%)	23 (100%)	0.31
Partner-reported improvement	Not assessed	21 (91.3%)	

COMPLICATIONS

Peniflex was associated with seroma requiring puncture in 87 patients (37.5%). Additional complications included implant displacement (2.15%), implant prolapse (0.43%), and decreased erection (0.43%).

Table 3. Complications by Implant Type

Complication	Peniflex (n=232)	Penogrande (n=23	p-value
Seroma requiring puncture	87 (37.5%)	1 (4.3%)*	<0.001
Infected hematoma	0 (0%)	1 (4.3%)	0.08
Fibrotic scar affecting pump function	0 (0%)	1 (4.3%)	0.08
Implant displacement	5 (2.15%)	0 (0%)	0.61
Implant prolapse	1 (0.43%)	0 (0%)	0.91
Decreased erection	1 (0.43%)	0 (0%)	0.91
Pain during full inflation	N/A	2 (8.7%)	-
Total requiring reoperation I I I	7 (3.0%)	2 (8.7%)	0.17

PENOGRANDE COMPLICATIONS INCLUDED:

- Prolonged seroma: One patient (4.3%) developed a persistent seroma requiring three puncture aspirations over a 2-month period and a 4-week course of prophylactic antibiotics.

- Infected hematoma: One patient (4.3%) developed a postoperative hematoma with secondary infection at 3 weeks, requiring surgical drainage and debridement with implant salvage and 6 weeks of culture-directed antibiotics.

- Fibrotic scar impairing pump function: One patient (4.3%) developed significant fibrotic scar tissue surrounding the scrotal pump mechanism, requiring surgical revision with scar excision and pump repositioning.

- Pain during full inflation: Two patients (8.7%) reported mild to moderate discomfort during full inflation, which resolved with patient education.

No Penogrande implants required removal. Two patients (8.7%) required reoperation—one for infected hematoma drainage and one for fibrotic scar revision.

Table 4. Outcomes in Penogrande Patients with Partial ED (n=14)

Outcome	Result
Age (years)	43.2 ± 5.6
Baseline IIEF-5	17.2 ± 2.1
12-month IIEF-5	21.5 ± 2.4
Mean IIEF-5 improvement	4.3 ± 1.8 points
VOED confirmed (Doppler)	8 (57.1%)
PDE5i users at baseline	12 (85.7%)
PDE5i users at 12 months	3 (21.4%)
PDE5i reduction/elimination	11 (78.6%)
Reported improved rigidity	12 (85.7%)
Satisfied with dual function	13 (92.9%)

PENOGRANDE IN PATIENTS WITH PARTIAL ERECTILE DYSFUNCTION

In the subgroup of 14 Penogrande patients with pre-existing partial erectile dysfunction, International Index of Erectile Function-5 scores improved from 17.2 ± 2.1 to 21.5 ± 2.4 at 12 months ($P < 0.01$). Improved rigidity during inflation was reported by 12 patients (85.7%), and 11 patients (78.6%) reduced or eliminated phosphodiesterase type 5 inhibitor use.

For the 8 patients with confirmed veno-occlusive erectile dysfunction, the implant's structural support appeared to compensate for the venous leak by providing external rigidity, effectively bypassing the hemodynamic insufficiency that made phosphodiesterase type 5 inhibitors less effective.

Discussion

PRINCIPAL FINDINGS

This study provides the first direct comparison between solid silicone penile implants (Peniflex) and the novel inflatable extracorporeal Penogrande implant. Our principal findings include:

1. Both implant types achieve high patient satisfaction (>90%) and significant improvements in self-confidence and sexual quality of life.

2. Penogrande demonstrates greater dimensional outcomes, particularly in length gain (3.11 cm vs. 1.47 cm) and functional girth upon inflation (6.7 cm vs. 4.9 cm).

3. Penogrande substantially reduces seroma formation compared with Peniflex (4.3% vs. 37.5%, $P < 0.001$), though the inflatable device introduces unique complications including infected hematoma (4.3%) and fibrotic scar affecting mechanical function (4.3%).

4. For patients with partial erectile dysfunction, Penogrande provides unique dual functionality—cosmetic enhancement combined with structural support that improves erectile rigidity and reduces dependence on pharmacotherapy.

THE SEROMA CHALLENGE: SOLID VS. INFLATABLE IMPLANTS

The 37.5% seroma rate observed with Peniflex represents a significant clinical burden. While seromas are typically self-limited and respond to aspiration, they require additional medical visits, increase patient anxiety, and may delay return to normal activities[20]. The dramatic reduction in seroma formation with Penogrande (4.3%) likely reflects the different surgical plane and the ability to maintain light compression through the deflated device during initial healing. However, the single case of prolonged seroma in the Penogrande group requiring three punctures and extended antibiotic therapy demonstrates that this complication is not entirely eliminated and may require more intensive management than with solid implants.

UNIQUE COMPLICATIONS OF INFLATABLE IMPLANTS

The Penogrande group experienced three complications not observed in solid implant patients: infected hematoma (4.3%), fibrotic scar affecting pump function (4.3%), and prolonged seroma (4.3%). While the overall reoperation rate was 8.7% (2 of 23 patients), this did not reach statistical significance compared with Peniflex (3.0%, $P = 0.17$) given the sample size.

Infected hematoma represents a serious complication that carries risk of implant loss. In our case, prompt surgical drainage and culture-directed antibiotics allowed implant salvage. This highlights the importance of early recognition and aggressive

management of infectious complications in implant surgery. Fibrotic scar affecting pump function is a well-recognized complication of scrotal pump placement in traditional inflatable prostheses.21 Our case underscores that careful surgical technique, including creation of a well-defined pouch and avoidance of excessive dissection, may reduce this risk.

THE ERECTILE DYSFUNCTION ADVANTAGE

The most compelling finding of this study is the demonstrated benefit of Penogrande for patients with partial erectile dysfunction, including those with veno-occlusive dysfunction. Traditional management of veno-occlusive erectile dysfunction remains challenging—venous surgery has disappointing long-term success (<40%),15 while three-piece inflatable prostheses are typically reserved for severe erectile dysfunction[16].

For the large population of men with mild-to-moderate erectile dysfunction who are dissatisfied with phosphodiesterase type 5 inhibitors (due to side effects, inconsistent response, or the psychological burden of "pill dependency"), Penogrande offers a novel solution. By providing external structural support during inflation, the device compensates for insufficient cavernosal rigidity without replacing the native erectile mechanism. This is conceptually distinct from traditional prostheses that replace corporal function entirely. The 85.7% of patients reporting improved rigidity and 78.6% reducing or eliminating phosphodiesterase type 5 inhibitor use suggest that Penogrande may serve as a "middle ground" intervention—more invasive than oral pharmacotherapy but less destructive than traditional prostheses, while simultaneously addressing cosmetic concerns.

CLINICAL IMPLICATIONS

Based on our findings, we propose the following patient selection algorithm:

- For patients seeking purely permanent cosmetic enhancement with no erectile concerns: Solid silicone implants (Peniflex/Himplant) remain an excellent option with proven long-term durability.10,13 Patients should be counseled regarding the high likelihood of postoperative seroma requiring puncture.

- For patients seeking cosmetic enhancement who have concurrent partial erectile dysfunction (International Index of Erectile Function-5 score 15–21), including veno-occlusive erectile dysfunction: Penogrande offers the unique advantage of dual functionality—cosmetic enhancement plus erectile support. Patients should be counseled about the absence of long-term results (3–5 years) due to the novelty of Penogrande.

- For patients with severe erectile dysfunction (International Index of Erectile Function-5 score <11): Traditional three-piece inflatable prostheses remain the gold standard[16].

LIMITATIONS

This study has several limitations that should be addressed in future investigations:

1. Unequal group sizes (232 vs. 23)
2. Nonrandomized design with potential selection bias
3. Short-term follow-up (12 months)
4. Potential single-surgeon bias for Penogrande
5. Lack of objective erectile dysfunction assessment in all patients
6. Small sample size for precise complication rate determination

Conclusion

This study demonstrates that solid silicone implants Peniflex and the novel inflatable extracorporeal Penogrande implant achieve high patient satisfaction and meaningful penile enlargement. Penogrande offers several distinct advantages: greater dimensional outcomes (length gain 3.11 cm vs. 1.47 cm and functional girth upon inflation 6.7 cm vs. 4.9 cm), substantial reduction in postoperative seroma (from 37.5% to 4.3%), dual functionality for patients with partial erectile dysfunction (cosmetic enhancement combined with structural support that improves erectile rigidity and reduces phosphodiesterase type 5 inhibitor dependence), and a more physiological experience (the ability to inflate and deflate more closely mimics natural erectile cycling). However, surgeons and patients must be aware of the unique complication profile associated with this novel inflatable device, including infected hematoma (4.3%), fibrotic scar affecting pump function (4.3%), and prolonged seroma (4.3%). While no implants were lost in this series, these complications required surgical reintervention in 8.7% of patients.

For the growing population of men seeking penile enhancement, the availability of options tailored to

individual needs represents significant progress. As the field of aesthetic andrology continues to evolve, the integration of cosmetic enhancement with functional restoration represents the next frontier. Longer follow-up and larger comparative studies are needed before recommending Penogrande over solid implants for general use.

Conflict of Interest Statement:

Dr. Knigavko participated in the development of the Penogrande implant. Dr. Aguilar participated in the development of the Peniflex implant.

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Author Contributions:

Oleksandr Knigavko: study conception, surgical procedures (Peniflex and Penogrande), data collection, manuscript drafting.

Ivan Aguilar: surgical procedures (Peniflex), data collection, critical revision.

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