

Original Research

ERECTILE FUNCTION IMPROVEMENT FOLLOWING EXCISION AND RECONSTRUCTION FOR PENILE SCLEROSING LIPOGRANULOMA: AN OBSERVATIONAL STUDY IN SOUTHEAST INDONESIA

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ABSTRACT

Introduction: Penile sclerosing lipogranuloma (PSL) is a chronic inflammatory condition caused by foreign material injection into the penis. Patients often present with pain, deformity, and impaired sexual function. Although operative intervention remains the cornerstone of PSL management, quantitative data on postoperative erectile function remain limited. This study evaluated changes in erectile function after surgery using a standardised scoring system.

Method: This quantitative observational analytic study used a pretest-posttest design. Patients diagnosed with PSL who underwent operative intervention were included. We classified disease severity using Soebhali's classification. Erectile function was measured pre- and postoperatively using the International Index of Erectile Function-5 (IIEF-5). We performed statistical analyses to assess changes in erectile function and their association with disease severity and operative technique.

Results: We included 11 patients, with a mean age of 31.09 years. Most patients were sexually active and presented with Soebhali category 2 disease. Penile deformity was the main complaint. The mean interval from injection to presentation was 4.82 years. Operative intervention consisted of excision followed by primary closure in seven patients and one-stage bipedicle scrotal flap reconstruction in four patients. All patients showed improvement in the postoperative IIEF-5 scores, with statistical significance ($p = 0.005$). Improvement was not associated with initial disease severity or operative technique.

Conclusion: Operative intervention of PSL leads to meaningful improvement in erectile function. The benefit appears to be related to effective lesion excision and restoration of penile tissue integrity rather than disease severity or reconstruction.

Keywords: Penis; Granuloma; Foreign body; Erectile dysfunction.

Latar Belakang: Penile sclerosing lipogranuloma (PSL) merupakan kondisi inflamasi kronis akibat penyuntikan bahan asing ke dalam penis. Pasien umumnya datang dengan keluhan nyeri, deformitas penis dan gangguan fungsi seksual. Tindakan pembedahan merupakan terapi utama, namun data kuantitatif mengenai perbaikan fungsi pasca-pembedahan masih terbatas. Penelitian ini bertujuan untuk mengevaluasi perubahan fungsi ereksi setelah pembedahan menggunakan sistem penilaian yang terstandar.

Metodologi: Penelitian ini merupakan studi observasional analitik kuantitatif dengan desain pretest-posttest. Pasien dalam penelitian ini adalah pasien PSL yang menjalani tindakan operatif. Derajat keparahan penyakit diklasifikasikan menggunakan klasifikasi Soebhali. Fungsi ereksi dinilai sebelum dan sesudah operasi menggunakan International Index of Erectile Function-5 (IIEF-5). Analisis statistik dilakukan untuk menilai perubahan fungsi ereksi serta hubungannya dengan derajat penyakit dan teknik operasi yang dilakukan.

Hasil: Sebanyak 11 pasien diikutsertakan dalam penelitian ini, dengan rerata usia 31 tahun. Mayoritas pasien aktif secara seksual dan termasuk dalam kategori Soebhali derajat 2. Deformitas penis merupakan keluhan utama. Rerata interval antara penyuntikan dan kunjungan awal adalah 4,82 tahun. Tindakan operatif berupa eksisi dengan penutupan primer pada tujuh pasien dan rekonstruksi flap scrotal bipedikular satu tahap pada empat pasien. Seluruh pasien menunjukkan perbaikan bermakna pada fungsi ereksi pascaoperasi berdasarkan skor IIEF-5 ($p = 0,005$). Perbaikan tersebut tidak berhubungan dengan derajat keparahan awal maupun jenis teknik operatif yang dilakukan.

Received: 22-01-2026, Revised: 13-03-2026, Accepted: 23-05-2026

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Kesimpulan: Tatalaksana operatif pada PSL memberikan perbaikan bermakna pada fungsi ereksi. Manfaat ini tampaknya berkaitan dengan eksisi lesi yang adekuat dan pemulihan integritas jaringan penis, terlepas dari derajat penyakit maupun teknik rekonstruksi.

Kata Kunci: penis; granuloma, benda asing; disfungsi ereksi.

Conflicts of Interest Statement:

The author(s) listed in this manuscript declare the absence of any conflict of interest on the subject matter or materials discussed.

INTRODUCTION

Since early ages, many adult males have sensed the need to enlarge their penis for sexual pleasure with their partner or for their own self-confidence. This is the reason many adult males tend to enlarge their penis size by injection of foreign material. This injection can cause a disorder in the penis called penile sclerosing lipogranuloma (PSL).^{1,2}

Usually, the injection is done illegally by a non-medical practitioner without clearly knowing the complications. Injection materials include silicone, polyacrylamide, mineral oils (coconut oil, palm oil, olive oil), Vaseline, paraffin, petroleum jelly, and other traditional substances. These kinds of materials cannot be broken down or metabolised because the human body cannot break down exogenous lipids, resulting in a foreign body reaction.^{1,3} The most common body reaction is a change in penile appearance, such as swelling, redness, and thickening of the penile skin, accompanied by pain, ulcers, symptoms of erectile dysfunction, and voiding difficulty. Many adult males had this injection without knowing the effect on the body, and later came to seek help from health care professionals.^{4,5}

Europe and Asia have the most reported cases. In Europe, especially Eastern Europe, Bulgaria (19,8%) and Hungary (14,3%) have the most reported cases.^{6,7} Meanwhile, Korea (31,7%) has the most cases reported globally. In Southeast Asia, five countries reported 13,6% of total cases: Malaysia, Singapore, Thailand, Laos, and Myanmar.⁷ No publication to date has reported the incidence of PSL in Indonesia; however, several case reports have been documented.^{1,8-11}

Currently, no standardised guidelines exist for managing PSL. The primary goals of treatment are to restore both the functional and aesthetic aspects of the penis as a sexual organ. In

line with current principles in reconstructive and urological surgery, successful management is increasingly evaluated not only by anatomical restoration but also by the recovery of functional outcomes such as erectile function.¹²⁻¹⁴ In clinical practice, operative intervention is often combined with conservative medical management in the treatment of PSL.^{1,4,6} However, erectile function following operative intervention for PSL has rarely been systematically assessed, either clinically or in research settings, particularly in Indonesia. This study therefore aimed to address this gap by evaluating the improvement of erectile function after operative intervention in patients with PSL.

METHOD

This quantitative, observational, analytic study used a pre-experimental pretest-posttest design. The study was conducted at the Government General Hospital, Kupang, East Nusa Tenggara, Indonesia. The study period covered patients who underwent operative intervention for PSL from January 2023 to February 2025.

We identified participants through consecutive sampling using hospital medical records. Inclusion criteria included all patients with PSL who underwent operative intervention. Exclusion criteria included patients who did not complete both preoperative and postoperative IIEF-5 questionnaires, declined to participate, or had incomplete clinical records. We obtained written informed consent from all patients before they participated in this study.

The primary outcome was postoperative erectile function, objectively measured by the IIEF-5. We also evaluated PSL severity and operative techniques as contributing clinical variables. Additional patient characteristics included age, sexual activity, interval between injection and presentation, reason for injection, and indication for operative intervention.

We measured erectile function using the IIEF-5 questionnaire, which the authors manually translated into Indonesian. The questionnaire consists of five items, each scored from 1 to 5, yielding a total score of 5 to 25. Erectile function was categorised as follows: no erectile dysfunction (22–25), mild (17–21), mild to moderate (12–16), moderate (8–11), and severe erectile dysfunction (5–7).¹⁵ Each patient completed the questionnaire twice, at the initial preoperative consultation and at least five months after the operative intervention. The same operative team performed all interventions: one plastic surgeon and one urologist.

We classified PSL severity according to Soebhali's classification, which categorises the extent of the lesion based on anatomical involvement.¹ Category 1 represents a minimal lesion involving less than one-third of the penile shaft, without suprapubic or scrotal involvement. Category 2 includes lesions involving more than one-third of the penile shaft but without extension to the suprapubic or scrotal area. Category 3 refers to lesions involving the penile shaft with suprapubic extension and up to half of the scrotum. Category 4 represents the most extensive disease, with lesions involving the penis, suprapubic region, and more than half of the scrotum.

We performed statistical analyses to assess differences in pre- and postoperative IIEF-5 scores. We also analysed differences in IIEF-5 scores by preoperative severity and reconstruction technique. We processed all data using a spreadsheet application and performed statistical analyses using GNU PSPP 1.4.1, an open-source statistical software. Ethical approval was obtained from the Research Ethics Committee, Faculty of Medicine and Veterinary Medicine, Universitas Nusa Cendana (No. 116/UN15.16/KEPK/2023). This report is aligned with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guideline for transparent reporting of observational analytic studies.¹⁶

RESULTS

A total of 18 patients met the inclusion criteria and had operative intervention between January 2023 and September 2024. Seven patients lived in remote residences within the archipelagic region and were excluded because they were lost to follow-up. Consequently, 11 patients were included in the final analysis.

Table 1. Patients Characteristics

Characteristics	n (%)
Age at presentation, mean (standard deviation), years	31.09 ($\pm$ 8.43)
Sexual Activeness	
Sexually active	9 (81.81)
Not sexually active	2 (18.18)
Reason for Injection	
Peer influence	8 (72.72)
Self confidence	2 (18.18)
Pressure from others	1 (9.09)
Injection to presentation interval (standard deviation), years	4.82 ($\pm$ 3.49)
Severity	
Soebhali category 1	4 (36.36)
Soebhali category 2	5 (45.45)
Soebhali category 3	2 (18.18)
Soebhali category 4	0 (0.00)
Reason for the operation intervention	
Change in shape	10 (90.90)
Change in color	1 (18.18)
Pain	3 (27.27)
Itching	1 (18.18)
Operative techniques	
Excision with one-staged bipedicle scrotal flap	4 (36.36)
Excision with primary closure	7 (63.63)
Follow-up duration, mean (standard deviation), months	14.36 ($\pm$ 6.36)

Abbreviation: n, total number.

Patient Characteristics

The mean patient age was 31.09 ± 8.43 years, with a range of 19 to 42 years. Most patients were sexually active. The most common reason for injection was peer influence. The average time interval between injection and patient presentation was $4.82 (\pm 3.49)$ years. Based on Soebhali's classification, the most common degree of PSL was Category 2, and the most common reason for undergoing operative

intervention was penile deformity. Operative techniques performed included excision with primary closure in 7 patients and excision with a one-stage bipediced scrotal flap in 4 patients. The mean follow-up period was 14.36 ± 6.36 months (range 5-25 months). Table 1 summarises patient characteristics.

Pre- and Postoperative IIEF-5 Scores

Before operative intervention, most patients had mild to moderate erectile dysfunction according to the IIEF-5 classification. We assessed preoperative erectile function at the initial consultation, yielding a median IIEF-5 score of 17 (range 11-25), as shown in Table 2. Postoperatively, erectile function showed substantial improvement, with most patients falling into the "no erectile dysfunction" category and a median postoperative score of 25 (range 14-25).

Table 2. Distribution of erectile function pre- and postoperatively

IIEF-5 score	Pre-op	Post-op
No ED (22-25)	3 (27.27)	7 (63.63)
Mild (17-21)	3 (27.27)	3 (27.27)
Mild to moderate (12-16)	4 (36.36)	1 (18.18)
Moderate (8-11)	1 (9.09)	0 (0.00)
Severe ED (5-7)	0 (0.00)	0 (0.00)

Abbreviation: IIEF-5, International Index of Erectile Function; Pre, pretest; Post, posttest; ED, erectile dysfunction

To further assess the significance of this improvement, we performed a Wilcoxon signed-rank test, which showed a statistically significant improvement in postoperative erectile function compared with preoperative scores ($Z = -2.81$, $p = 0.005$), as shown in Table 3. This finding indicates a consistent and significant improvement in erectile function following operative intervention.

Table 3. Pre- and postoperative erectile function

IIEF-5 score	n	Min	Max	Med	p
Pre	11	11	25	17	0.005
Post	11	14	25	25	

Abbreviation: IIEF-5, International Index of Erectile Function; n, total number; Pre, pretest; Post, posttest; Min, minimal; Max, maximal; p, p-value.

Erectile Function by Initial PSL Severity

The distribution of postoperative outcomes based on IIEF-5 score across the initial severity of PSL severity (based on Soebhali's classification) is presented in Table 4. Overall, patients with lower-grade PSL (categories 1 and 2) achieved higher postoperative IIEF-5 scores, ,

whereas only one patient in category 3 showed moderate improvement.

A Pearson Chi-square test was also performed to compare the distribution of initial PSL severity with postoperative IIEF-5 score. The analysis showed a statistically insignificant difference in erectile function scores between initial PSL severity classifications.

Table 4. Distribution of the initial severity of PSL and postoperative outcome

Post-op IIEF-5 score	Pre-op PSL Categories based on Soebhali' score			Pearson Chi-Square Test
	1	2	3	
14	1 (9.1%)	0 (0%)	0 (0%)	$\chi^2 = 15.89$ df = 10 p = 0.103
18	0 (0%)	0 (0%)	1 (9.1%)	
20	1 (9.1%)	0 (0%)	0 (0%)	
21	0 (0%)	1 (9.1%)	0 (0%)	
23	0 (0%)	1 (9.1%)	0 (0%)	
25	2 (18.2%)	4 (36.4%)	0 (0%)	
Total	4 (36.4%)	6 (54.5%)	1 (9.1%)	

Abbreviation: IIEF-5, International Index of Erectile Function; Post, posttest; Pre, pretest; PSL, penile sclerosing lipogranuloma

Erectile Function by Operative Techniques

Table 5 presents the distribution of postoperative IIEF-5 scores across different operative techniques. Overall, patients who underwent excision with primary closure tended to have higher postoperative IIEF-5 scores than those treated with the one-stage bipediced scrotal flap technique.

Table 5. Distribution of operative techniques and postoperative outcome based on IIEF-5 score

IIEF-5 Post-op Score	Excision + One-stage Bipediced Scrotal Flap	Excision + Primary Closure	Pearson Chi-Square Test
14	0 (0%)	1 (9.1%)	$\chi^2 = 5.24$ df = 5 p = 0.388
18	1 (9.1%)	0 (0%)	
20	0 (0%)	1 (9.1%)	
21	1 (9.1%)	0 (0%)	
23	0 (0%)	1 (9.1%)	
25	2 (18.2%)	4 (36.4%)	
Total	4 (36.4%)	7 (63.6%)	

Abbreviation: IIEF-5, International Index of Erectile Function; Post, posttest; χ^2 , Pearson Chi-square statistic, df, degree of freedom, p, p-value.

We then conducted a Pearson chi-square test to compare the distribution of postoperative outcomes by IIEF-5 score across the two operative techniques. The analysis showed no statistically significant difference in the distribution of IIEF-5 scores between the techniques.

DISCUSSION

This pre-experimental pretest-posttest study evaluated operative intervention outcomes among PSL patients in Kupang, the capital city of an archipelagic province of Nusa Tenggara Timur in Southeast Indonesia, between January 2023 and February 2025. A total of 11 patients were included in the analysis and demonstrated a statistically significant improvement in erectile function following operative intervention for PSL.

Patient Characteristics

The characteristics observed in this study are consistent with those reported in the existing literature, with a mean patient age centred within the early third decade of life.^{1,6,7,11,17-21} This age distribution reflects a predominantly sexually active population, which is further supported by the finding that most patients in this cohort remained sexually active at the time of presentation, in line with previous reports.^{17,19,20,22} Peer influence was the predominant reason for penile enlargement in this study. This finding aligns with existing literature, particularly from Asian populations, where such practices are often driven by sociocultural perceptions of masculinity and reinforced by peer recommendation.²³

In geographically remote and resource-limited settings, limited access to medical education, lower health literacy, and reduced awareness of potential complications may further facilitate unregulated injection practices. The interval between injection and presentation to medical care varied widely, with a mean of 4.82 ± 3.49 years, comparable to the range reported in the literature, which spans approximately 0.78 to 7 years. Notably, clinical manifestations related to chronic inflammatory processes are known to begin within 1–2 years following injection, suggesting that many patients sought medical care well after symptom onset.^{1,6,17,19,20,24,25}

This delayed presentation likely reflects postponed health-seeking behaviour, which may be partly attributable to the socially sensitive and

taboo nature of PSL, potentially discouraging affected individuals from seeking medical attention early in the disease course.¹⁹ Within this context, Soebhali category 2 emerged as the most prevalent severity at the time of consultation, with penile deformity being the most common presenting complaint, consistent with findings in the existing literature.^{6,8,26} This pattern suggests that Soebhali category 2 represents a critical clinical threshold at which disease progression becomes sufficiently prominent, characterised by advancing fibrosis and chronic inflammation involving the penile shaft, resulting in visible deformity, induration, ulceration, and pain.

In contrast, the more subtle manifestations seen in early-stage disease (Soebhali category 1) may allow patients to defer medical consultation. At Soebhali category 2 stage, patients remain capable of engaging in sexual intercourse despite noticeable anatomical changes, which aligns with the preserved sexual activity observed in both this and previous studies^{6,8,26}. Nevertheless, varying degrees of erectile dysfunction were evident in a subset of patients, as reflected by preoperative IIEF-5 scores, indicating that symptoms associated with PSL Soebhali category 2 may already exert a measurable impact on sexual function.

The mean follow-up duration in this study was 14.36 ± 6.36 months, with variable follow-up intervals among patients. This range is comparable to that reported in the literature, where follow-up durations commonly span from approximately 3 to 27 months, with some studies demonstrating even broader variability.^{6,7,17,20,27-34} Nevertheless, longer-term follow-up remains essential, as residual foreign material may contribute to delayed recurrence of lipogranuloma in the reconstructed area.

Pre- and Postoperative IIEF-5 Scores

The primary outcome of this study was postoperative erectile function, which improved significantly following operative intervention for PSL, as measured by the postoperative IIEF-5 score. Most patients transitioned from mild to moderate erectile dysfunction preoperatively to no erectile dysfunction postoperatively, from 17 preoperative IIEF-5 score to 25 postoperatively (Wilcoxon signed-rank test, $Z = -2.81$, $p = 0.005$). This finding is consistent with the limited number of studies that reported satisfactory postoperative outcomes with postoperative IIEF-5 scores of ≥ 23 .^{11,21,35} Other available studies have

similarly demonstrated favourable clinical outcomes after operative intervention.^{6,8,11,24,26,32,36-38}

However, most literature did not quantitatively evaluate postoperative outcomes using standardised scoring systems. This aligns with Downey et al. (2019), who reported that up to 91% of patients presenting with PSL required operative intervention, underscoring that surgery remains the cornerstone of PSL management.⁷ A plausible pathophysiological basis for postoperative erectile function improvement is likely the removal of non-metabolizable foreign material and fibrotic tissue, which alleviates chronic inflammation and relieves structural tethering of the subcutaneous tissue.^{1,17,33,37-42} This restoration may help reestablish normal cavernosal dynamics by improving the veno-occlusive condition and sinusoidal compliance.⁴³⁻⁴⁸ In addition, the resolution of pain and the restoration of a more normal penile contour may also contribute to enhanced psychological aspects in patients that further support erectile function.^{26,38,49-52}

Erectile Function by Initial PSL Severity

This study demonstrated a trend toward better postoperative erectile function, as reflected by a higher postoperative IIEF-5 score, among patients with lower initial PSL severity based on Soebhali's classification. However, despite this pattern, Pearson chi-square analysis did not show a significant association between initial PSL severity and postoperative outcomes. Direct comparison with the existing literature remains challenging, as studies that quantitatively assess initial PSL severity and postoperative outcomes using standardised scoring systems, and particularly those that compare both, are scarce.

Most published reports primarily emphasise clinical manifestations and overall operative outcomes rather than determined severity stratification and quantitative functional assessment.^{6,8,24,26,32,36,37} Nevertheless, the favourable erectile outcomes observed across Soebhali Categories 1-3 in the present study are consistent with available reports indicating that satisfactory erectile function can be achieved following adequate operative intervention, even in patients with higher initial disease severity.^{6,8,11,21,26,32,38}

Notably, Putra et al. (2019) reported substantial erectile recovery in a Soebhali

Category 3 case, with the IIEF-5 score improving from 10 preoperatively to 23 postoperatively.¹¹ From a pathophysiological standpoint, lower-grade PSL may allow more favourable erectile recovery due to limited tissue infiltration, inflammation, and anatomical distortion.^{1,17,33,42,48,53} In contrast, higher-grade disease is associated with more extensive structural involvement requiring wider excision and flap-based reconstruction, which may introduce additional tissue bulk that can impair penile hemodynamics or hinder vaginal penetration, thereby increasing the risk of suboptimal functional outcomes.^{29,45,53} Overall, these findings indicate that postoperative outcomes are more strongly influenced by the completeness of lesion excision and restoration of normal penile architecture rather than the initial severity of PSL itself. This may be explained by the underlying mechanism that functional recovery largely depends on the adequate removal of non-metabolizable foreign material and associated fibrotic tissue, which can alleviate chronic inflammatory reactions and relieve structural tethering of the penile subcutaneous tissue, thereby facilitating the restoration of normal penile anatomy and hemodynamics.

Erectile Function by Operative Techniques

This study observed a trend toward higher postoperative IIEF-5 scores among patients who underwent excision with primary closure (n=7) than those treated with one-stage bipediced scrotal flap reconstruction (n=4). However, the Pearson chi-square test showed no statistically significant difference between the two groups ($p > 0.05$; Table 4). This trend may reflect the small sample size, group imbalance, and differences in preoperative disease severity, as primary closure is typically used for limited lesions. In contrast, one-stage bipediced scrotal flaps are reserved for more extensive lesions that may already compromise prognosis, limit postoperative IIEF-5 improvement, and increase the risk of complications, independent of the operative techniques themselves.

To date, no direct head-to-head comparative studies have explicitly evaluated excision with primary closure versus one-stage bipediced scrotal flap reconstruction for PSL. Operative technique selection in the literature is largely based on disease extent, as reflected in staging systems like Soebhali's classification, in which

stage 1 PSL is typically managed with excision and primary closure. In contrast, stage 2 or higher disease often necessitates alternative reconstructive approaches such as skin grafts or flaps.⁶

Consistent with this approach, Gonidjaya et al. (2025) reported that excision with primary closure is generally reserved for limited defects involving less than one-third of the penile shaft with intact surrounding skin, while one-stage bipediced scrotal flap reconstruction is favoured for extensive circumferential defects exceeding one-third of the shaft with or without suprapubic or scrotal involvement.²⁶ Operative intervention for PSL, either through excision followed by primary closure or one-stage bipediced scrotal flap reconstruction, aims to completely remove non-metabolised foreign material and granulomatous tissue to restore continence, preserve sexual and reproductive function, and achieve satisfactory aesthetic outcomes.^{1,24,53,54}

The choice of operative technique depends primarily on the extent of the lesion and the availability of residual penile skin.^{6,7} Excision with primary closure involves direct skin approximation and is generally feasible for focal defects involving less than one-third of the shaft circumference.^{1,21,26,53} In smaller defects, this approach may preserve native penile vascularity and innervation while minimising tissue disruption, maintaining thin, compliant penile skin, and avoiding donor-site morbidity compared with bulkier bipediced scrotal flap reconstruction.^{29,53,55}

However, primary closure becomes unsuitable for larger defects due to excessive skin shortening and scarring, which may render the penile skin too stiff or insufficient to permit normal erection, as well as due to the increased risk of tension-related ischemia and wound dehiscence. Consequently, its application is largely limited to Soebhali category 1 and selected category 2 lesions.^{1,7,21,26,29,53,56} In contrast, a one-stage bipediced scrotal flap represents a more versatile reconstructive option for extensive defects, particularly in Soebhali category 3 or higher.

In larger defects, one-stage bipediced scrotal flaps provide superior skin laxity, addressing tissue deficiency and preventing excessive tension that could otherwise cause ischemia, wound dehiscence, or tension during erection.^{6,29,53} These advantages are attributable

to the elasticity of scrotal skin and its robust bipediced vascular supply via the deep external pudendal arterial system.^{6,29,53} Nevertheless, despite its superiority in managing extensive tissue loss, the inherent bulkiness of the one-stage bipediced scrotal flap may adversely affect penile hemodynamics, particularly the veno-occlusive mechanism, and potentially interfere with vaginal penetration during intercourse, resulting in less optimal recovery of erectile function when compared with excision followed by primary closure.^{29,45,48,53} An additional drawback of scrotal flap reconstruction is the risk of a "hairy penis", which may affect cosmetic satisfaction and sexual intercourse.^{1,6,30} These observations between the two operative techniques underscore the importance of operative technique selection based on lesion extent to achieve complete lesion excision.

Strengths and Limitations

This study has several notable strengths. First, it provides one of the few quantitative evaluations of postoperative outcomes through erectile function assessment using the IIEF-5 questionnaire in patients with PSL, thereby addressing a clear gap in the existing literature, which is largely limited to descriptive reports and case series. Second, the pretest-posttest design with within-subject comparison allows each patient to serve as their own control, strengthening assessment of functional change after operative intervention despite the absence of a comparator group. Third, disease severity was systematically classified according to Soebhali's classification, enabling a structured analysis of postoperative outcomes across varying extents of lesion involvement. Fourth, the same plastic surgeons and urologist performed all operative interventions, minimising interoperator variability and enhancing procedural consistency. Lastly, this study provides clinically relevant insight into PSL management in an archipelagic region where delayed presentation and unregulated penile injection remain prevalent.

Several limitations warrant consideration. First, the relatively small sample size ($n = 11$) limits statistical power and increases the likelihood of type II error. Given the retrospective nature of the study and the limited number of available PSL cases, an a priori power calculation was not feasible, as the sample size was determined by the number of eligible patients

presenting during the study period. This limitation is also reflected in the uneven distribution of disease severity, including the absence of Soebhali Category 4 cases and the limited representation of Category 3 disease. The small number of patients may further reflect the tendency of individuals with PSL to rarely seek medical attention due to social stigma, embarrassment, and the illicit nature of penile foreign material injections, which may contribute to underreporting of cases. In addition, the study was conducted in a geographically remote and archipelagic region where healthcare access and communication infrastructure remain limited, potentially reducing patients' ability to seek medical care. Second, variability in postoperative follow-up intervals may have introduced imprecision in outcome assessment. This variability likely reflects the study setting, where geographical barriers and limited access to healthcare services may make it challenging for some patients to return for scheduled follow-up evaluations. Differences in follow-up timing may therefore affect the magnitude of postoperative IIEF-5 improvement observed. Lastly, we assessed erectile function using a manually translated, non-validated Indonesian version of the IIEF-5 questionnaire, as no validated version was available at the time of the study. While using a non-validated instrument may introduce imprecision in absolute scoring, consistently applying the same questionnaire in both pre- and postoperative assessments likely minimises systematic bias in within-subject comparisons, rendering this limitation largely nondifferential.

The findings are most generalizable to PSL patients managed operatively in similar clinical settings, particularly in regions where delayed presentation and comparable disease patterns are common. Caution is warranted when interpreting these results for patients with more advanced disease or alternative operative techniques. Larger, multicentered studies employing standardised severity classification systems, validated outcome measures, and uniform follow-up protocols are warranted to better define the role of operative intervention in optimising functional recovery, guiding evidence-based operative decision-making, clarifying expected functional outcomes across the spectrum of PSL severity, and further evaluating the potential influence of patient- and disease-related variables such as age and the

interval between injection and surgical intervention.

CONCLUSION

Operative intervention for PSL is associated with meaningful improvement in postoperative erectile function. Erectile function outcomes appear to be driven primarily by the completeness of lesion excision and effective restoration of penile tissue integrity, rather than by the initial extent of lesion or the specific operative technique employed.

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ACKNOWLEDGEMENT

The authors sincerely thank all patients who participated in this study. The authors conducted this research independently, without external funding or sponsorship.

FUNDING

The authors received no additional technical, financial, or editorial assistance in preparing this article.

DECLARATION OF GENERATIVE AI USE

The authors declare that no generative artificial intelligence (AI) tools were used in the preparation, writing, or revision of this manuscript.

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