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Staged Bulbar Urethroplasty Using Bilateral Perineal Skin Flaps as the Urethral Plate

Üretral Yatak Olarak Bilateral Perineal Deri Fleplerinin Kullanıldığı Aşamalı Bulber Üretroplasti

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Abstract

Objective: To assess outcomes of staged bulbar urethroplasty using bilateral perineal skin flaps as urethral plate substitutes in patients with obliterative or nearly obliterative bulbar urethral strictures.
Materials and Methods: A retrospective analysis was conducted on 19 male patients with severe bulbar urethral strictures who underwent two-stage urethroplasty using scrotal or penile fasciocutaneous flaps. Inclusion criteria included urethral mucosa widths less than 3 mm and stricture length exceeding 3 cm. Initially, perineal skin flaps reconstructed the urethral plate. Six months later, a tubularized neourethra was created using scrotal or penile flaps. Patients were evaluated preoperatively and at 1 month and 6 months postoperatively using uroflowmetry and International Prostate Symptom Score (IPSS).
Results: Patient ages ranged from 27 to 76 years, with a median of 60. The median stricture length was 4.6 cm. For those with cystostomy, median IPSS at six months post-surgery was 5 (range: 0-8). Postoperative Qmax values at first (Qmax-1) and sixth months (Qmax-6) were 22 ml/s (range: 14–26 ml/s) and 21 ml/s (range: 14–29 ml/s). In patients with urinary difficulties, the maximum urinary flow rate (Qmax) improved from 4.6 to 20 ml/s post-surgery ($p = 0.0001$), with IPSS reduction from 23 to 4 ($p = 0.005$). Complications were minimal, with no infections, fistulas, or penile deformities. Two patients developed circular strictures requiring internal urethrotomy, and three experienced terminal dribbling.
Conclusion: Staged urethroplasty using bilateral perineal skin flaps is viable and effective for complex bulbar urethral strictures. This method shows favorable functional and cosmetic outcomes with low complications, particularly where single-stage repair is unfeasible.

Keywords: bulbar urethral strictures, staged urethroplasty, perineal skin flaps

Özet

Amaç: Obliteratif veya obliterasyona yakın bulber üretral darlığı olan hastalarda, üretral yatak yerine bilateral perineal deri flepleri kullanılarak yapılan aşamalı bulber üretroplasti sonuçlarını değerlendirmek.
Gereçler ve Yöntemler: Şiddetli bulber üretral darlığı bulunan 19 erkek hasta üzerinde retrospektif analiz yapıldı. Hastalara iki aşamalı üretroplasti uygulandı. Dahil edilme kriterleri üretral mukozanın < 3 mm genişliğe sahip olması ve darlık uzunluğunun > 3 cm olmasıydı. İlk aşamada perineal deri flepleri ile üretral yatak rekonstrükte edildi. Altı ay sonra skrotal veya penil flepler kullanılarak tübülerize neouretra oluşturuldu. Hastalar preoperatif dönemde ve postoperatif 1. ve 6. aylarda üroflowmetri ve Uluslararası Prostat Semptom Skoru (IPSS) ile değerlendirildi.
Bulgular: Hasta yaşları 27–76 yıl arasında olup medyan yaş 60 idi. Medyan darlık uzunluğu 4,6 cm olarak bulundu. Sistostomisi olan hastalarda, cerrahi sonrası 6. ayda medyan IPSS 5 (0–8 aralığında) idi. Postoperatif maksimum idrar akım hızları (Qmax) 1. ayda 22 ml/sn (14–26 ml/sn aralığında), 6. ayda ise 21 ml/sn (14–29 ml/sn aralığında) idi. İşeme güçlüğü olan hastalarda Qmax, cerrahi sonrası 4,6 ml/sn'den 20 ml/sn'ye yükseldi ($p = 0,0001$); IPSS ise 23'ten 4'e düştü ($p = 0,005$). Komplikasyonlar minimaldi; enfeksiyon, fistül veya penil deformite görülmedi. İki hastada internal üretrotomi gerektiren dairesel darlık gelişti, üç hastada ise terminal damlama gözlendi.
Sonuç: Bilateral perineal deri flepleri kullanılarak yapılan aşamalı üretroplasti, kompleks bulber üretral darlıkların tedavisinde uygulanabilir ve etkili bir yöntemdir. Tek aşamalı onarımın mümkün olmadığı durumlarda, düşük komplikasyon oranı ile birlikte fonksiyonel ve kozmetik açıdan yüz güldürücü sonuçlar sağlamaktadır.

Anahtar kelimeler: bulber üretral darlık, aşamalı üretroplasti, perineal deri flepleri

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Introduction

Urethral stricture disease (USD) is a common and complex condition characterized by narrowing of the urethral lumen due to scar tissue formation following urethral injury. The etiology of USD includes external trauma, genitourinary infections, inflammatory dermatological conditions, pelvic radiotherapy, and iatrogenic factors such as urethral instrumentation and endoscopic surgery [1,2]. Although USD can occur in any segment of the male urethra, the bulbar (43%) and penile (37%) segments are most frequently affected [3].

The management of bulbar urethral strictures remains a subject of debate, primarily due to the heterogeneous characteristics of the strictures and variations in surgeon preference. There is no universally accepted optimal procedure for all patients with bulbar urethral stricture. The appropriate repair strategy should be selected based on stricture length, urethral lumen width, the degree of spongiofibrosis, and the underlying etiology [4,5]. Excision and primary anastomosis (EPA) tension-free is considered the most effective surgical option for short bulbar urethral strictures measuring < 2 cm [6]. For strictures > 2 cm in length, substitution urethroplasty using grafts or flaps are required.

Substitution urethroplasty can be performed using either single-stage or staged procedures [7]. Single-stage repair is generally appropriate for simple strictures, whereas staged procedures may be necessary for more complex disease [8]. Fuchs et al. reported a preference for single-stage repair in most cases, with only 30% of patients requiring staged reconstruction [9]. Although the frequency of staged procedures has decreased substantially, they remain an important option in urethral reconstructive surgery. Several critical factors must be considered when deciding between a single-stage and staged approach, including the condition of the urethral plate, the extent of spongiofibrosis, the length of the harvested graft, chordee formation, and the suitability of the urethral graft bed [6].

The precise definition of severe bulbar urethral stricture remains a topic of discussion, as highlighted in the most recent EAU guidelines [10]. Palminteri et al. suggested that a urethral plate measuring less than 3 mm should be classified as a severe stricture, and that severe urethral strictures encompass high-grade, nearly obliterative, and obliterative types [11]. Hoy et al. also emphasized that two-stage repair is necessary in cases of lichen sclerosus, a history of multiple failed hypospadias repairs, or the presence of an obliterated or nearly obliterated urethral lumen [12]. In this study, we report our experience with staged repair using scrotal or penile skin flap urethroplasty in patients with severe bulbar urethral stricture.

Materials and Methods

In this retrospective study, 19 patients diagnosed with bulbar urethral stricture who underwent two-stage urethroplasty using scrotal or penile skin flaps were included. In patients without a suprapubic cystostomy, voiding function was assessed using the International Prostate Symptom Score (IPSS), uroflowmetry (UF), maximum urine flow rate (Qmax), and postvoid residual (PVR) urine volume. Retrograde urethrography (RUG) was performed in all patients to determine the location and length of the urethral stricture. In patients with a suprapubic cystostomy, antegrade cystography with intravesical contrast instillation was additionally performed to more accurately delineate the proximal extent of the stricture. A meticulous physical examination of the oral, genital, perineal, and rectal regions was conducted in all patients.

Buccal mucosal graft (BMG) urethroplasty was offered as the first-line treatment option. Similarly, in patients with an endoscopic appearance suggestive of lichen sclerosus (LS) or in the presence of panurethral stricture, BMG was recommended. In contrast, patients with poor oral hygiene, those who declined BMG, those in whom the urethral plate was considered inadequate to support graft vascularization, or those with a history of failed prior urethroplasty were offered skin flap urethroplasty instead. Patients with a hairless perineum or with only minimal perineal hair that would not interfere with the operative field were considered suitable candidates for skin flap urethroplasty. In patients with excessive perineal hair, perineal/scrotal hair removal was performed by electrocauterization during the first stage, whereas in those unsuitable for cauterization it was achieved by laser epilation prior to the second-stage. Laboratory evaluation included urinalysis, urine culture, and serum biochemical analyses, including renal function tests. All patients were thoroughly informed about the surgical procedure, and written informed consent was obtained prior to surgery. The study protocol was approved by the Clinical Research Ethics Committee of Gazi University School of Medicine (No: 2025 - 1027- date: May 27, 2025).

Surgical Technique

All surgical procedures were performed by a single surgeon. In the first stage, under general anesthesia, patients were placed in the dorsal lithotomy position to access the bulbar urethra. After appropriate positioning, the lower abdomen, genital region, and perineum were scrubbed with povidone-iodine for five minutes. Initially, urethroscopy was performed to visualize the strictured segment of the urethra and, when feasible, to advance a guidewire into the bladder. The bulbar urethra was then

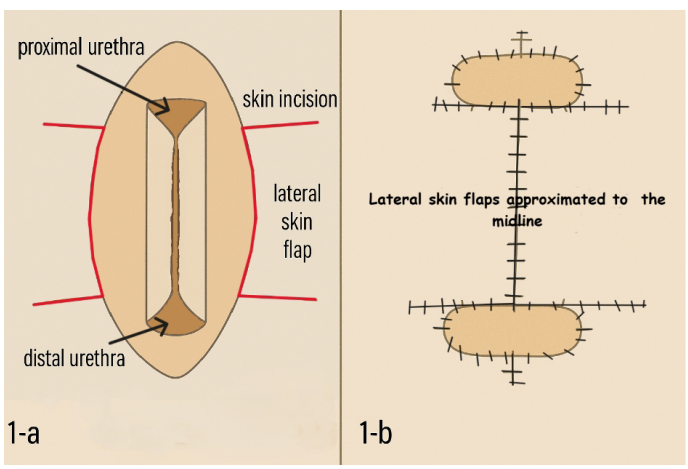

Figure 1. Perineal midline incision to exposure of obliterative bulbar urethra (a) Exposure of the urethral plate and design of the skin incision (b) Each lateral skin flap was approximated in the midline to reconstruct the urethral plate

exposed through a midline perineal incision, and the strictured segment was identified. The narrowed urethral segment was incised proximally and distally until healthy urethral tissue was reached. The criteria for choosing a staged urethroplasty were a urethral mucosal width of less than 3 mm at the stricture site and a stricture length exceeding 30 mm.

Following placement of an 18 Fr urethral catheter, bilateral perineal skin flaps were mobilized and approximated, and the edges of the urethral mucosa were sutured to the perineal skin flaps using 4-0 polyglactin sutures. In cases of obliterative bulbar urethral stricture, the fibrotic urethral segment was excised, the bilateral skin flaps were approximated and sutured in the central perineum with 4-0 polyglactin sutures, and then anastomosed to the proximal and distal urethral ends (**Figures 1 and 2**). The urethral catheter was removed on the fifth postoperative day, during which no complications were observed. Patients were able to void comfortably in the sitting position through the perineostomy.

Six months after the initial procedure, the second-stage of the reconstruction was performed. In this stage, depending on the length of the urethral defect in the perineum, either a penile or a scrotal fasciocutaneous flap was prepared. For the scrotal fasciocutaneous flap, a hairless midline area was preferred. The width of the fasciocutaneous flap ranged from 15 to 20 mm, according to the width of the existing urethral plate. The flap was transferred to the anastomotic site through a tunnel created in the midline of the scrotum, without torsion or excessive tension on the pedicle. Under 2.5X magnification, the flap was anastomosed to the urethral plate over an 18 F urethral Foley catheter using 5-0 polydioxanone sutures, ensuring a tension-free repair. The anastomotic area was then covered with surrounding soft tissue. After meticulous hemostasis to prevent postoperative hematoma, the skin and subcutaneous tissues were closed in layers, and a compression dressing was applied to the perineal region. No suprapubic catheter or perineal drain was used. Patients received parenteral third-generation cephalosporins for five days, followed by oral ciprofloxacin 500 mg twice daily until catheter removal. The urethral Foley catheter was left in place for 21 days.

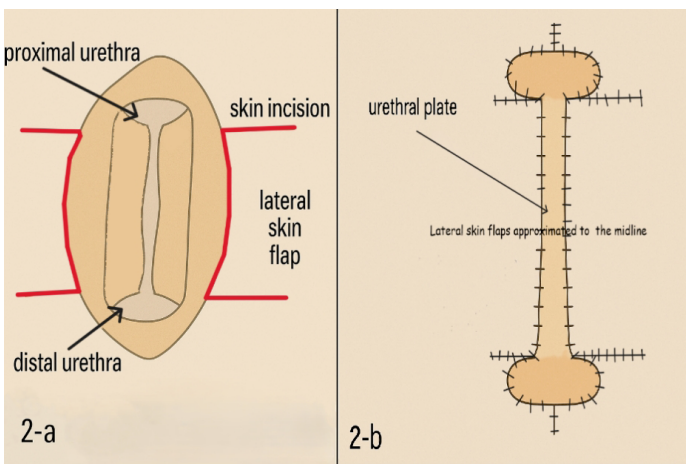

Figure 2. Perineal midline incision to exposure of nearly obliterative bulbar urethra (a) Exposure of the urethral plate and design of the skin incision (b) Each lateral skin flap was approximated in the midline to reconstruct the urethral plate

Follow-up

Patients were evaluated at the first and sixth months after the reconstruction. In patients without a suprapubic cystostomy, urine flow was assessed by UF preoperatively, at the first postoperative month, and at the sixth postoperative month. In this group, the IPSS questionnaire was administered preoperatively and at the sixth postoperative month. In patients with a suprapubic cystostomy, uroflowmetry was performed at the first and sixth postoperative months, and the IPSS questionnaire was administered at the sixth postoperative month. Urethroscopy was performed in patients who developed voiding difficulties or whose Qmax was less than 10 mL/s. After the 6-month evaluation, patients were instructed to return if they experienced any subsequent voiding difficulties.

Statistical Analysis

Descriptive and inferential statistical methods were used for the analysis. Quantitative variables are presented as median and range, whereas qualitative variables are expressed as frequencies and percentages. The Mann–Whitney U test was used for comparisons between independent groups. The Wilcoxon signed-rank test was applied to compare paired variables within groups, and the Friedman test was used for comparisons of repeated measures with three time points. A p-value of < 0.05 was considered statistically significant.

Results

The median age of the patients was 60 years (27–76). The etiology of the stricture, number of prior endoscopic interventions, presence of complete obstruction on RUG, presence of suprapubic cystostomy, and stricture length are summarized in **Table 1**. A scrotal fasciocutaneous flap was used in 8 patients, whereas a penile fasciocutaneous flap was used in 11 patients. The median follow-up duration after the second-stage repair was 30 months (12–60).

The participants were divided into two cohorts: Cohort 1 consisted of patients with a suprapubic cystostomy, whereas

Table 1. Demographic and clinical characteristics of the patients

Age (year) (median, min-max)	**60 (27-76)**
Etiology	
Traumatic catheterization (n, %)	6 (31,5%)
Endoscopic procedures (n, %)	5 (26,3%)
Straddle trauma (n, %)	8 (42,2%)
Internal urethrotomies ≥3 (n, %)	11 (57,8%)
Suprapubic cystostomy (n, %)	9 (47,3%)
Complete obstruction on RUG (n, %)	8 (42,2%)
Stricture length (cm) (median, min-max)	5 (3,5-7)

Cohort 2 included patients without a suprapubic cystostomy. In Cohort 1, the median age was 55 years (27–72), and the median stricture length was 5.7 cm (3.5–7). Preoperative Qmax and IPSS values were not available for this cohort. Postoperative Qmax values at the first (Qmax-1) and sixth months (Qmax-6) were 22 mL/s (14–26) and 21 mL/s (14–29), respectively, with no statistically significant difference between these two time points ($p = 0.521$). The median IPSS at 6 months postoperatively was 5 (0–8). In Cohort 2, the median age was 63 years (46–76), and the median stricture length was 4.4 cm (3.5–5). The preoperative Qmax (Qmax-0), and postoperative Qmax values at the first (Qmax-1) and sixth months (Qmax-6) were 4.6 mL/s (3–8), 20 mL/s (14–25), and 16 mL/s (14–21), respectively. A statistically significant difference was observed among these three time points $p < 0.001$, primarily attributable to the low preoperative Qmax-0 values. The postoperative Qmax values at the first and sixth months were approximately fourfold higher than the preoperative values. The median preoperative and 6-month postoperative IPSS values were 23 (18–25) and 4 (3–5), respectively, with a statistically significant difference ($p = 0.005$). There were no statistically significant differences between the two cohorts in terms of age, stricture length, or postoperative Qmax and IPSS values (all $p > 0.05$) (**Table 2**).

No early postoperative complications such as wound dehiscence, perineal hematoma, urinary tract infection, or wound infection were observed. In addition, no urethrocutaneous fistula, penile rotation, or penile curvature occurred. Within the first postoperative week, penile edema was documented in 2 patients and scrotal edema in 3 patients; all cases resolved spontaneously within 1 week. Two patients (10.5%), one from cohort 1 and one from cohort 2, underwent laser-assisted internal urethrotomy 12 months after the repair because of persistent voiding difficulties despite a Qmax of 14 mL/s. In these patients, circular strictures were identified at the proximal anastomotic site. No recurrent stricture was observed after internal urethrotomy. Three patients (15.7%) reported terminal dribbling. In cohort 1, one patient (5%) developed a saccular dilatation in the flap segment, which did not require further intervention. No additional complications were recorded. Overall, the patients reported satisfaction with the cosmetic appearance of the penis.

Table 2. Comparison of preoperative and postoperative outcomes

	SPC (n=9)	Non-SPC (n=10)	P value
Age (year) (median, min-max)	55 (27-72)	63 (46-76)	0,25
Stricture length (cm) (median, min-max)	5,7 (3,5-7)	4,4 (3,5-5)	0,16
Preoperative Qmax (ml/s)	NA	4,6 (3-8)	
Postoperative Qmax-1 months (ml/s)	22 (14-26)	20 (14-25)	0,652
Postoperative Qmax-6 months (ml/s)	21 (14-29)	16 (14-21)	0,460
Preoperative IPSS	NA	23 (18-25)	
Postoperative IPSS-6 months	5 (0-8)	4 (3-5)	

SPC: suprapubic cystostomy; IPSS: international prostate symptom score; Qmax: maximum urine flow rate

Discussion

There is still no consensus regarding the optimal technique, particularly with respect to whether a graft or flap should be used and whether the repair should be performed as a primary or staged procedure. Although single-stage repairs are generally effective in the treatment of most bulbar urethral strictures, staged repair may be required in certain cases. In our practice, the criteria for perineal urethrostomy were defined as a urethral mucosal width of less than 3 mm and a stricture length exceeding 30 mm. Current EAU guidelines recommend that staged procedures be considered when the urethral plate is inadequate for single-stage surgery [10]. A urethral lumen wider than 6 Fr has been defined as the criterion for an acceptable urethral plate [13], and Palminteri et al. similarly reported that a urethral mucosal width of less than 3 mm indicates an inadequate urethral plate [11]. Preoperative RUG corroborated these intraoperative findings.

Urethral mucosal width is a critical parameter in determining the suitability of staged urethroplasty. Penile and scrotal island flap urethroplasty provides well-vascularized, pliable, and reliable tissue for urethral substitution. Penile and scrotal skin flaps can be easily transferred to the site of bulbar urethral stricture for reconstruction. The cosmetic appearance of the penis following wound healing remained satisfactory. Our study suggests that staged urethroplasty should be considered in patients with obliterative or nearly obliterative bulbar urethral strictures. In our approach, bilateral perineal skin flaps were used instead of buccal or dermal skin grafts in the first stage to create a healthy urethral plate. At 12 months after the repair, only two patients required a single internal urethrotomy session. Based on these outcomes, this staged technique was considered successful. Furr et al. reported a long-term success rate of 93% with their two-stage urethroplasty technique using BMG [14]. In our study, the success rate was 89.5%.

In the current literature, the indications for staged urethroplasty include an obliterative or nearly obliterative segment in the bulbar urethra, lichen sclerosus, and previously failed hypospadias repairs [7,11,12,15]. In the management of urethral strictures associated with lichen sclerosus (LS), the use of genital skin-based flaps or grafts is not recommended [16]. EPA is not an appropriate repair method for strictures longer than 2–3 cm, and single-stage substitution urethroplasty may not be feasible when the urethral plate is insufficiently wide. In such cases, as previously described, perineal urethrostomy is performed in the first stage. After healing of the urethral plate, urethral reconstruction with a flap or graft procedure is performed in the second-stage. Various grafts have been described, including penile, scrotal, and extragenital skin, bladder mucosa, colonic mucosa, and buccal mucosa. Initially, skin grafts or flaps were used for substitution bulbar urethroplasty [4,17,18]. Grafts are easier to harvest, are associated with lower donor-site morbidity, and are quicker to apply [12]. Most surgeons prefer

grafts for urethral reconstruction because flap preparation is technically more demanding and complex [19]. However, the quality of the graft bed is crucial for graft survival, as it must be suitable for imbibition and inosculation [20]. In addition, Andrich et al. reported that grafts tend to shrink over time, leading to deterioration of the long-term outcomes of urethral reconstruction using grafts [15]. In a systematic review, Barratt et al. investigated the optimal technique for graft placement in single-stage repair of bulbar urethral strictures and reported that the outcomes of bulbar free-graft urethroplasty tended to worsen over time [21]. For these reasons, we preferred to use penile and scrotal skin flaps for the repair of severe bulbar urethral strictures.

After confirmation that the graft has healed without complications, an interval of at least four to six months is recommended before proceeding with tubularization of the urethra [4,7,22]. We prefer to wait six months before performing the second-stage repair. Although sacculation or pseudodiverticulum formation has been reported to occur more frequently with pedicled flaps than with grafts, due to the tendency to oversize the flap [6], only one patient in our cohort developed saccular urethral dilatation. In certain clinical situations, such as oral leukoplakia, poor oral hygiene combined with heavy tobacco smoking or chewing, prior irradiation, or previous buccal mucosa graft (BMG) harvesting, BMG is either not feasible or not advisable. A urologist proficient in safely harvesting different types of grafts has a clear advantage in urethral reconstruction [23].

Following perineostomy or the first stage of staged urethroplasty, the catheter may be removed after three to five days without the need for urethrography [24,25]. After urethroplasty, it is generally recommended that an indwelling catheter be maintained for 2–3 weeks [26,27]. In our study, the catheter was removed on the fifth day after the first stage and in the third week after the second-stage.

This study has several limitations that should be acknowledged. First, its retrospective design may have introduced selection and information bias, potentially affecting the internal validity of the findings. Second, the absence of a control group treated with graft-based or single-stage urethroplasty limits the ability to make direct comparisons regarding the relative efficacy and safety of different reconstructive approaches. Third, the small sample size further restricts the generalizability of the results to broader patient populations. In addition, although postoperative outcomes were assessed using standard measures such as uroflowmetry and the IPSS, the study did not employ a urethra-specific, validated patient-reported outcome instrument, such as the Urethral Stricture Surgery Patient-Reported Outcome Measure (USS-PROM), which is specifically designed to capture both voiding function and health-related quality of life and could have provided a more comprehensive evaluation of treatment outcomes.

Conclusions

In conclusion, this study provides important insight into the outcomes of staged repair using scrotal or penile skin flaps for the treatment of bulbar urethral strictures. In patients with obliterative or nearly obliterative bulbar urethral strictures, staged urethroplasty using fasciocutaneous skin flaps should be regarded as a valuable and effective reconstructive option.

Ethics Committee Approval: The study protocol was approved by the Clinical Research Ethics Committee of Gazi University School of Medicine (No: 2025 - 1027- date: May 27, 2025).
Informed Consent: An informed consent was obtained from all the patients.
Publication: The results of the study were not published in full or in part in form of abstracts.
Peer-review: Externally peer-reviewed.
Authorship Contributions: Any contribution was not made by any individual not listed as an author. Concept – A.A., E.C.B., F.P., S.Y.; Design – A.A., M.Y.K.; Supervision – A.A., B.E., F.P., S.Y.; Resources – M.Y.K., E.C.B., B.E., F.P., S.Y.; Materials – M.Y.K., B.E.; Data Collection and/or Processing – M.Y.K., E.C.B., B.E.; Analysis and/or Interpretation – M.Y.K., E.C.B., B.E.; Literature Search – E.C.B., B.E., F.P., S.Y.; Writing Manuscript – A.A., F.P., S.Y.; Critical Review – A.A., F.P., S.Y.
Conflict of Interest: The authors declare that they have no conflicts of interest.
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