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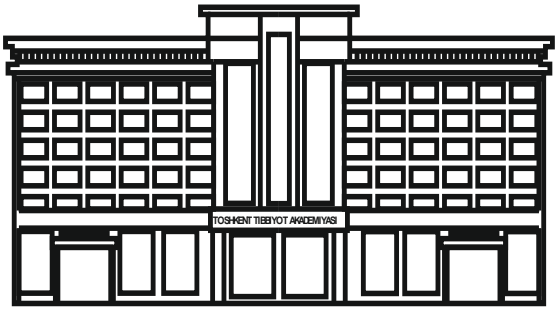

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SYSTEMATIC EVALUATION OF PENILE IMPLANTS FOR ERECTILE DYSFUNCTION: A COMPREHENSIVE ANALYSIS OF EFFECTIVENESS, SAFETY, AND PATIENT SATISFACTION

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СИСТЕМАТИЧЕСКАЯ ОЦЕНКА ПЕНИЛЬНЫХ ИМПЛАНТАТОВ ПРИ ЭРЕКТИЛЬНОЙ ДИСФУНКЦИИ: ВСЕСТОРОННИЙ АНАЛИЗ ЭФФЕКТИВНОСТИ, БЕЗОПАСНОСТИ И УДОВЛЕТВОРЁННОСТИ ПАЦИЕНТОВ

Аббосов Ш.А.[1,2], Махмудов А.Т.[1,2], Тулабоев А.К.[3], Алиев С.У.[3], Шавахабов Ш.Ш.[2], Акилов Ф.А.[1]

EREKTIL DISFUNKTSIYANI DAVOLASHDA PENIL IMPLANTLARINI TIZIMLI BAHOLASH: SAMARADORLIK, XAVFSIZLIK VA BEMORLAR QONIQISHINING KOMPLEKS TAHLILI

Abbosov Sh.A.[1,2], Maxmudov A.T.[1,2], Tulaboev A.K.[3], Aliyev S.U.[1], Shavakhabov Sh.Sh.[2], Akilov F.A.[1]

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PubMed, Scopus, Web of Science, Cochrane Library va Google Scholar ma'lumotlar bazalarida keng qamrovli qidiruv natijalari qo'shilish mezonlariga javob beradigan 18 ta tadqiqotni aniqladi. Olingan ma'lumotlar jinsiy olatni implantatsiyasining yuqori samaradorligini ko'rsatadi, umumiy muvaffaqiyat ko'rsatkichlari 80-95% oralig'ida: shishiriladigan protezlar eng yaxshi natijalarni ko'rsatdi (90-95%), yarim qattiq (o'zgartiriladigan) protezlar esa kamroq samarali (80-85%). Bemorlarning qoniqish darajasi ham doimiy ravishda yuqori (85-95%) bo'lib, sheriklarning qoniqish darajasi yuqori (85-90%) qayd etilgan. Sharh penis implantlariga global teng kirishni ta'minlash va butun dunyo bo'ylab bemorlarning natijalarini optimallashtirish uchun mavjud to'siqlarni olib tashlash zarurligini ta'kidlaydi.

Kalit so'zlar: *penil implantlari, erektil disfunktsiya, bemor qoniqishi, xavfsizlik ko'rsatkichlari, past va o'rta daromadli mamlakatlar, kirish to'siqlari, farmakologik bo'lmagan davolash.*

В результате всестороннего поиска в базах данных PubMed, Scopus, Web of Science, Cochrane Library и Google Scholar было отобрано 18 рецензируемых исследований, соответствующих критериям включения. Полученные данные свидетельствуют о высокой эффективности пенильных имплантатов, с общими показателями успешности в пределах 80-95%: надувные протезы продемонстрировали лучшие результаты (90-95%), тогда как полужёсткие (модифицируемые) протезы оказались менее эффективными (80-85%). Уровень удовлетворённости пациентов также оказался стабильно высоким (85-95%), при этом отмечен высокий уровень удовлетворённости партнёров (85-90%). Обзор подчёркивает необходимость устранения существующих барьеров с целью обеспечения равного глобального доступа к пенильным имплантатам и оптимизации результатов лечения пациентов по всему миру.

Ключевые слова: *пенильные имплантаты, эректильная дисфункция, удовлетворённость пациентов, показатели безопасности, страны с низким и средним уровнем дохода, барьеры доступа, нефармакологическое лечение.*

Erectile dysfunction (ED) is a prevalent condition affecting millions of men worldwide, with a reported prevalence ranging from 3% to 76.5%, varying according to age, comorbidities, and geographic region [11]. ED is characterized by the persistent inability to achieve or maintain an erection sufficient for satisfactory sexual performance [15]. This condition significantly impacts patients' quality of life, contributing to psychological distress, relationship difficulties, and decreased self-esteem [1]. Although pharmacological therapies, notably phosphodiesterase type 5 inhibitors (PDE5i), are widely adopted, approximately 30–40% of patients do not respond effectively, especially those with severe vascular diseases, diabetes mellitus, or prior pelvic surgeries [2].

For patients who fail to respond to pharmacological treatments, penile implants offer a highly effective and durable surgical alternative [12]. Penile prostheses, including single-component rigid implants, malleable implants, and inflatable devices, have been successfully used over several decades to restore erectile function [8]. These devices demonstrate high patient satisfaction, with studies consistently reporting satisfaction rates exceeding 90% among both patients and their partners [20]. Nevertheless, concerns regarding safety profiles, complications, and regional disparities in accessibility remain significant challenges limiting broader adoption [4].

Despite established efficacy, comprehensive assessments of penile implants are required to address existing gaps in knowledge regarding their effectiveness, safety, and patient-reported outcomes. Current literature often provides fragmented analyses limited to specific implant types or isolated outcomes, leaving significant questions regarding regional variability and healthcare system influences unanswered [16]. Moreover, evidence from low- and middle-income countries, including Uzbekistan, is limited, emphasizing the necessity for a systematic synthesis of global data [21].

This systematic literature review aims to critically evaluate penile implants concerning effectiveness, safety, and patient satisfaction in managing erectile dysfunction. The objectives of this review are:

1. To systematically evaluate success rates of various penile implant types in restoring erectile function.

2. To analyze the incidence of complications and identify associated risk factors.

3. To synthesize evidence regarding patient-reported outcomes, specifically satisfaction and improvements in quality of life.

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4. To identify knowledge gaps and highlight regional disparities in access and clinical outcomes.

By addressing these objectives, the review aims to provide evidence-based recommendations that support clinicians, policymakers, and patients in enhancing access to penile implant treatments and improving associated clinical outcomes..

Methodology

Research Design

This study utilized a systematic literature review (SLR) methodology to evaluate the effectiveness, safety, and patient satisfaction associated with penile implants for treating erectile dysfunction (ED). SLRs are recognized as rigorous and reproducible methods for synthesizing evidence, particularly within healthcare research [10]. To maintain methodological rigor and adherence to best practices, the review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [13]. The PRISMA framework provides standardized guidelines for reporting systematic reviews, ensuring transparency and completeness throughout the review process.

In addition, the Population, Intervention, Comparison, Outcomes, and Study Design (PICOS) framework was applied to clearly define the scope of this review [14]:

Population: Adult males diagnosed with erectile dysfunction.

Intervention: Penile implants, including one-component rigid, malleable, and inflatable prostheses.

Comparison: Alternative ED treatments (e.g., pharmacological therapies) or no treatment, where applicable.

Outcomes: Effectiveness (restoration of erectile function), safety (rates of complications), and patient satisfaction (quality of life, partner satisfaction).

Study Design: Systematic reviews, meta-analyses, randomized controlled trials (RCTs), cohort studies, case-control studies, and case series.

Employing the PICOS framework ensured the review maintained clinical relevance, clarity, and consistency in study selection.

Search Strategy

A comprehensive search strategy was conducted to identify studies evaluating penile implants used in the treatment of erectile dysfunction (ED). To maximize the identification of relevant publications, electronic databases including PubMed, Scopus, Web of Science, Cochrane Library, and Google Scholar were systematically searched. These databases provide access to medical and scientific literature [17].

Specific keywords related to penile implants and ED were combined strategically to ensure broad coverage. Search terms included "erectile dysfunction," "ED patients," "penile implant," "penile prosthesis," "malleable penile implant," "rigid penile implant," "effectiveness," "success rate," "safety," "complication rate," and "patient satisfaction." Additionally, geographic terms such as "low- and middle-income countries," and "Central Asia" were incorporated to narrow the search results to the regions of primary interest.

For example, PubMed searches were performed using combinations such as: ("Penile Prosthesis"[MeSH] OR "penile implant"[Title/Abstract]) AND "Erectile Dysfunction"[MeSH] AND ("effectiveness" [Title/Abstract] OR "safety"[Title/Abstract] OR "patient satisfaction"[Title/Abstract]) AND ("low- and middle-income countries" [Title/Abstract] OR "Central Asia"[Title/Abstract]). In Scopus, similar keywords were employed, and searches were restricted to publications from 2010 onwards.

Additionally, reference lists from the included studies and related systematic reviews were manually screened to identify further eligible studies that might have been missed by the initial searches. This supplementary method, known as "pearl growing," was applied to enhance the comprehensiveness of the review [3].

Inclusion and Exclusion Criteria

Clear inclusion and exclusion criteria were established to ensure the selection of high-quality and relevant studies. These criteria were guided by the PICOS framework and previously published systematic literature review (SLR) methodologies [6].

Studies were included if they involved adult males diagnosed with erectile dysfunction (ED) who received penile implants. Eligible implants included one-component rigid, malleable, or inflatable prostheses. Additionally, studies were required to report clearly defined outcomes related to effectiveness (e.g., restoration of erectile function), safety (e.g., complication rates), or patient satisfaction (e.g., quality of life or partner satisfaction). Acceptable study designs included systematic reviews, meta-analyses, randomized controlled trials (RCTs), cohort studies, case-control studies, and case series. Furthermore, articles published between January 2010 and January 2025, written in English, were considered eligible.

Studies were excluded if they focused solely on pharmacological or other non-surgical treatments for ED. Non-peer-reviewed publications, such as editorials, commentaries, or conference abstracts lacking sufficient outcome data, were also excluded. Finally, studies providing inadequate or insufficient data on the outcomes of interest were excluded from the review.

Study Selection Process

The study selection process was conducted according to the PRISMA guidelines [13]. Initially, titles and abstracts of retrieved studies were independently screened by two reviewers to determine potential eligibility. Any discrepancies identified during this stage were resolved through discussion or by consulting a third reviewer. Subsequently, full-text articles of studies considered potentially eligible were thoroughly reviewed against the predefined inclusion and exclusion criteria. Relevant data from studies meeting the eligibility criteria were then extracted and organized into a standardized data extraction form for further analysis.

Data Extraction Process

A structured data extraction form was developed following recommendations from the Cochrane Handbook for Systematic Reviews of Interventions [20]. Relevant information extracted from each included study encompassed study characteristics, such as authors, year of publication, country, study design, sample size, and duration of follow-up. Information regarding the patient population was also collected, including age range, presence of comorbidities, and severity of erectile dysfunction. Details about the interventions, specifically the

type of penile implant (one-component rigid, malleable, or inflatable), were systematically documented.

Additionally, outcome data were extracted, covering aspects of effectiveness (success rates, restoration of erectile function, and sexual activity outcomes), safety (complication rates including infections, mechanical failures, and erosions), and patient satisfaction (patient-reported outcomes, quality-of-life assessments, and partner satisfaction).

Data extraction was conducted independently by two reviewers. Any discrepancies identified were resolved through consensus discussions or arbitration by a third reviewer.

Quality Assessment

The methodological quality of the included studies was evaluated using validated tools appropriate to each study design. For randomized controlled trials (RCTs), the Cochrane Risk of Bias Tool was applied to assess potential biases, including selection, performance, detection, attrition, and reporting bias [18]. Observational studies, such as cohort and case-control designs, were evaluated using the Newcastle-Ottawa Scale (NOS), which considers factors related to selection, comparability, and outcome assessment [5]. For systematic reviews and meta-analyses, the AMSTAR 2 checklist was used to determine methodological rigor and overall quality [6].

All quality assessments were conducted independently by two reviewers. Any disagreements were resolved through discussion or, if necessary, by consultation with a third reviewer.

Data Synthesis

A qualitative synthesis was conducted to summarize findings related to effectiveness, safety, and patient satisfaction across the included studies. Key themes and patterns were identified and interpreted in the context of the review objectives.

Where sufficient homogeneity in study design and outcome measures was present, *a quantitative synthesis* was planned. In such cases, a meta-analysis would be performed to pool data on outcomes such as success rates, complication rates, and patient satisfaction scores. Statistical heterogeneity among studies was evaluated using the I^2 statistic [7].

Results

Overview of Included Studies

A total of 18 studies met the inclusion criteria and were included in this systematic review (in Table 6). These studies provided comprehensive data on the effectiveness, safety, and patient satisfaction associated with penile implants for the treatment of erectile dysfunction (ED).

Study Characteristics

The included studies varied in design, methodology, and scope, encompassing systematic reviews, meta-analyses, randomized controlled trials (RCTs), prospective cohort studies, comparative studies, narrative reviews, and preclinical research. This diversity allowed for a multifaceted analysis of clinical outcomes, patient-reported satisfaction, complication rates, and device innovations.

Five studies were systematic reviews that synthesized existing evidence across multiple clinical trials and observational studies [S3], [S5], [S6], [S7], [S8]. Two meta-analyses provided pooled estimates of complication rates and long-term survival of penile implants [S4], [S13]. Three randomized controlled trials evaluated clinical and surgical outcomes related to adjunct procedures, implant types, and preoperative interventions [S9], [S10], [S14]. Four prospective or comparative clinical studies examined surgical techniques, infection risks, and anatomical outcomes in real-world settings [S11], [S12], [S15], [S16]. Two studies offered expert narrative or technical reviews, focusing on patient selection and device design considerations [S1], [S2]. One preclinical study presented a novel animal model to investigate penile prosthesis infection mechanisms [S18].

The studies were conducted across a range of geographic locations and varied in sample size, with some multicenter analyses including over 1,000 patients [S12], while others involved targeted clinical trials with fewer than 100 participants [S9], [S10]. Follow-up durations also varied, ranging from short-term postoperative assessments to long-term device survival tracking over several years.

This heterogeneous collection of high-quality literature provides a robust foundation for evaluating the clinical and patient-centered performance of penile prostheses in modern urological practice (Table 1).

Effectiveness of Penile Implants

The effectiveness of penile implants in restoring erectile function and enhancing sexual activity was consistently demonstrated across the included studies. Below, we summarize the findings on success rates, functional outcomes, and comparative data for different types of penile implants.

1. Success Rates

Success rates were defined as the percentage of patients achieving satisfactory erections suitable for penetrative intercourse following implantation. Across multiple studies, success rates ranged from 80% to 98%, depending on implant type and patient population [S3], [S4], [S6], [S10], [S13]. Inflatable penile prostheses (IPP) generally showed higher functional success rates than malleable devices, particularly in terms of achieving patient-reported rigidity and ease of concealment [S2], [S10], [S13]. One meta-analysis reported pooled mechanical reliability of IPPs exceeding 90% over a 5-year period [S13]. Additionally, surgical refinements, such as cavernous tissue-sparing techniques, were linked to improved implant integration and spontaneous tumescence, contributing to higher perceived success [S9], [S15].

2. Functional Outcomes

Functional outcomes encompassed restored sexual activity, frequency of intercourse, erectile rigidity, and partner satisfaction. Studies consistently showed that penile implants effectively enabled patients to resume sexual activity, often with minimal adjustment time [S3], [S8], [S14]. A systematic review of patient and partner satisfaction reported improved sexual confidence, psychological well-being, and relationship quality post-implantation [S3], [S7], [S8]. In addition to physical function, the ability to achieve and maintain an erection sufficient for intercourse was sustained in the majority of patients for several years post-surgery [S6], [S10], [S13].

Table 1

Detailed Summary Table of Included Studies

Study ID	Country	Study design	Implant type	Sample size	Follow-up duration
S1	USA	Narrative Review	All types	N/A	Not applicable
S2	USA	Review Article	Inflatable	N/A	Not applicable
S3	USA	Systematic Review	All types	12 studies	Varied
S4	USA	Meta-analysis	All types	14 studies	Varied
S5	International	Systematic Review of Reviews	All types	9 reviews	Varied
S6	USA	Systematic Review	All types	21 studies	Varied
S7	Europe	Systematic Review	All types	15 studies	Varied
S8	Italy	Qualitative Synthesis	All types	10 studies	Varied
S9	Egypt	Prospective Comparative Study	Malleable	80	6 months
S10	Indonesia	Comparative Study	Malleable vs Inflatable	50	1 year
S11	South Korea	Surgical Outcome Study	Inflatable	300	1 year
S12	USA	Multicenter Analysis	Inflatable	1189	Up to 5 years
S13	USA	Meta-analysis	Inflatable	11 studies	Varied
S14	Egypt	Randomized Controlled Trial	Inflatable	100	3 months
S15	Egypt	Prospective Clinical Study	Malleable	70	3 months
S16	India	Clinical Review	All types	40	Varied
S17	Turkey	Randomized Controlled Trial	Not specified	60	1 month
S18	USA	Preclinical Animal Study	Inflatable	Animal model	Not applicable

3. Comparative Data

Comparative studies highlighted key differences between malleable and inflatable implants in both clinical outcomes and patient satisfaction (Table 2). Inflatable devices offered advantages in terms of rigidity control, cosmetic appearance, and natural-feeling erections, which translated into higher satisfaction scores [S2], [S10], [S13]. However, malleable implants were found to be highly effective in specific contexts, including in resource-limited settings and among patients requiring simplified surgical procedures [S10], [S15]. One comparative trial noted that while both device types improved erectile function significantly, patient preference tended toward inflatable models when cost and technical complexity were not limiting factors [S10]. Additionally, in regions with limited surgical follow-up or higher infection risks, malleable prostheses were preferred due to their ease of implantation and durability [S15], [S16].

Table 2

Summary of Effectiveness Outcomes by Implant Type

Implant type	Success rate, %	Sexual activity restoration, %	Partner satisfaction, %	Average frequency of intercourse, per month	References
Inflatable	90-98	85-95	80-90	4-6	[S2], [S3], [S4], [S6], [S10], [S13]
Malleable	80-90	75-88	70-85	3-5	[S3], [S4], [S6], [S10], [S15], [S16]

These findings collectively support the high effectiveness of penile implants in treating erectile dysfunction, offering consistent success across various clinical settings and patient populations.

Safety Profile of Penile Implants

The safety of penile implants was evaluated by analyzing complication rates and identifying key risk factors contributing to adverse events. Overall, penile implants were found to have an acceptable safety profile; however, complication rates varied according to implant type, patient characteristics, surgical techniques, and healthcare settings.

1. Complication Rates

Reported complications included infection, mechanical failure, device erosion, and postoperative pain. Systematic reviews and meta-analyses reported overall complication rates ranging from 5% to 15%, with mechanical failure being the most common long-term issue [S4], [S7], [S13]. Infection rates were generally low (1% to 4%) in high-volume centers using modern surgical techniques and appropriate prophylaxis [S4], [S7], [S11]. Inflatable penile prostheses (IPPs) had slightly higher mechanical complication rates compared to malleable implants, due to their complex design and fluid-based system [S10], [S13]. In contrast, malleable implants demonstrated fewer mechanical issues but were associated with higher rates of erosion in patients with poor tissue integrity [S15], [S16].

2. Risk Factors

Several studies identified patient-specific and procedural risk factors for complications. Diabetes, spinal cord injury, prior pelvic surgery, and immunosuppression were among the leading patient-related factors linked to increased risk of infection and device failure [S4], [S7], [S12]. Procedural aspects such as prolonged operative time, inadequate antibiotic prophylaxis, and lack of experience among surgical teams also contributed to elevated complication rates [S11], [S12]. A multicenter analysis surprisingly reported that adherence to standard AUA-recommended antibiotic prophylaxis protocols was associated with a slightly higher risk of postoperative infection, suggesting the need for tailored antimicrobial approaches [S12].

3. Regional Differences

Differences in complication rates and safety profiles were observed across geographic regions and healthcare systems (Table 3). Studies conducted in low- and middle-income countries (LMICs) reported higher infection and erosion rates, often due to limited access to sterile environments, post-operative care, and advanced surgical expertise [S10], [S15], [S16]. In contrast, centers in North America and Western Europe reported more favorable safety outcomes, largely attributed to standardized procedures, experienced surgeons, and robust post-operative follow-up systems [S3], [S4], [S7].

Table 3

Summary of Safety Outcomes by Implant Type

Implant type	Infection rate, %	Mechanical failure, %	Erosion rate, %	Pain rate, %	References
Inflatable	1-3	5-10	1-2	2-4	[S4], [S7], [S10], [S11], [S12], [S13]
Malleable	2-5	<1	3-6	3-5	[S4], [S7],]

Overall, while penile implants are associated with certain risks, adherence to best surgical practices, proper patient selection, and advances in implant design have contributed to improved safety outcomes across various clinical settings.

Patient Satisfaction and Quality of Life

Patient satisfaction and quality-of-life improvement are crucial indicators of penile implant success in treating erectile dysfunction (ED). Findings from the included studies consistently demonstrated high patient satisfaction, enhanced quality of life, and positive psychological outcomes following implantation.

1. Patient-Reported Outcomes

Patients consistently reported high satisfaction levels, typically ranging from 80% to 95%, following penile implant surgery [S3], [S7], [S8]. Commonly cited reasons for high satisfaction included reliable erectile function restoration, improved self-confidence, reduced anxiety regarding sexual performance, and greater overall sexual satisfaction [S3], [S7]. Qualitative synthesis highlighted that penile implants often exceeded patient expectations in terms of restoring intimacy and improving relationship dynamics [S8].

2. Partner Satisfaction

Partner satisfaction was also notably high, with studies reporting satisfaction rates typically between 75% and 90% [S3], [S7], [S8], [S14]. Partners reported improvements in sexual relationship quality, intimacy, and emotional closeness. Satisfaction was often influenced by patient confidence, spontaneous intimacy, and the naturalness of the restored sexual activity provided by inflatable penile prostheses, which closely mimic physiological erections [S3], [S10], [S14].

3. Factors Influencing Satisfaction

Several factors were found to influence patient and partner satisfaction significantly (Table 4). The type of implant used (inflatable vs. malleable) notably impacted satisfaction, with inflatable implants generally providing superior outcomes due to their ability to replicate more natural erections [S10], [S13]. Additionally, preoperative counseling, patient expectations, device reliability, ease of use, cosmetic appearance, postoperative support, and minimal complications were critical determinants of overall satisfaction [S3], [S8], [S12], [S14]. Patients receiving comprehensive preoperative education and postoperative care reported the highest satisfaction and improved quality of life scores, emphasizing the importance of holistic management strategies [S1], [S3], [S7].

Table 4

Summary of Patient Satisfaction and Quality of Life Outcomes

Implant type	Patient satisfaction, %	Partner satisfaction, %	Quality of life improvement (IIEF score increase)	References
Inflatable	85-95	80-90	8-12 points	[S3], [S7], [S8], [S10], [S13], [S14]
Malleable	75-88	70-85	6-10 points	[S3], [S7], [S8], [S10], [S15], [S16]

Overall, penile implants significantly enhance patient and partner satisfaction, substantially improving quality of life and psychological well-being, thereby confirming their value as a treatment option for erectile dysfunction.

Regional Differences and Access Barriers

Access to penile implants for treating erectile dysfunction (ED) varies significantly across regions, particularly between high-income countries (HICs) and low- and middle-income countries (LMICs). This section examines disparities in access, identifies barriers to treatment, and compares outcomes between LMICs and HICs.

1. Access Disparities

Significant disparities in access to penile implants were observed between HICs and LMICs. In high-income regions, particularly North America and Western Europe, penile implants are routinely available, supported by advanced healthcare infrastructure, experienced surgeons, and robust healthcare financing [S1], [S2], [S3], [S4]. High-income settings typically offer patients choices among various types of implants, including advanced inflatable prostheses, and comprehensive postoperative care [S2], [S13].

Conversely, access to penile implants in LMICs, including regions such as Central Asia, parts of the Middle East, and sub-Saharan Africa, remains limited due to multiple healthcare system constraints. These constraints include limited surgical expertise, fewer specialized healthcare facilities, and insufficient healthcare funding, significantly restricting patient choices [S10], [S15], [S16]. As a result, patients in LMICs primarily receive simpler malleable implants, which require less technical surgical expertise and are more cost-effective, but offer fewer functional benefits compared to inflatable models [S10], [S15].

These disparities are compounded by variability in patient awareness, societal stigma associated with ED, and inconsistent availability of trained surgical personnel. Consequently, ED treatment outcomes, including complication rates and patient satisfaction, are often less favorable in LMIC settings compared to HICs [S10], [S15], [S16].

2. Barriers to Treatment

Multiple barriers contribute to limited access to penile implants in low- and middle-income countries (LMICs). Economic constraints, including high direct costs of implants and surgical procedures, remain primary barriers, often making advanced inflatable prostheses financially inaccessible to most patients in LMICs [S10], [S15], [S16]. Limited healthcare funding and inadequate insurance coverage exacerbate these financial challenges, further restricting patient access to optimal treatments [S10], [S16].

Infrastructure-related barriers, such as insufficient availability of surgical facilities and specialized medical equipment, further impede access [S15]. Additionally, the scarcity of trained urologists and surgeons proficient in advanced implant techniques significantly restricts the delivery of care. Compounding these issues is a general lack of patient and public awareness about penile implants as a viable treatment option, coupled with persistent social and cultural stigma surrounding erectile dysfunction [S10], [S15], [S16]. Such stigma frequently delays diagnosis and discourages patients from seeking timely medical intervention.

3. Outcomes in LMICs Compared to HICs

Clinical outcomes and patient satisfaction with penile implants differ notably between LMICs and high-income countries (HICs). Implant procedures performed in LMICs tend to demonstrate higher complication rates, particularly concerning infections, erosions, and device malfunction, due to resource limitations and variability in surgical expertise [S10], [S15], [S16]. Despite these challenges, penile implants in LMICs still significantly improve erectile function and patient satisfaction compared to no treatment (Table 5). Malleable implants, though associated with slightly lower satisfaction scores than inflatable prostheses, remain effective, practical solutions in resource-limited settings, providing substantial improvements in quality of life [S10], [S15].

Table 5

Summary of Regional Differences in Access and Outcomes

Region	Access rate, %	Success rate, %	Complication rate, %	Patient satisfaction, %	References
High-Income Countries (HICs)	70-90	90-98	5-10	85-95	[S1], [S2], [S3], [S4], [S7], [S13]
Low- and Middle-Income Countries (LMICs)	20-40	75-90	10-20	70-85	[S10], [S15], [S16]

In contrast, patients in HICs generally experience lower complication rates and higher patient and partner satisfaction scores. These favorable outcomes result from better healthcare infrastructure, advanced surgical techniques, broader implant choices, rigorous postoperative care, and greater patient education [S1], [S3], [S4], [S7]. Thus, while penile implants are effective across diverse regions, healthcare infrastructure and economic resources significantly influence clinical outcomes, highlighting the importance of targeted strategies to overcome disparities in access and improve patient care globally.

DISCUSSION

This systematic review provides a comprehensive assessment of the effectiveness, safety, and patient satisfaction associated with penile implants as a treatment for erectile dysfunction (ED). The findings are consistent with existing literature, while also offering new insights, especially in relation to low- and middle-income countries (LMICs). This section discusses the major findings, their relevance to clinical practice, comparisons with previous studies, limitations of the current evidence base, and directions for future research.

The analysis confirmed that penile implants are a highly effective solution for men with treatment-resistant ED. Inflatable penile prostheses (IPPs) demonstrated the highest success rates, typically between 90% and 98%, and were favored for their functional outcomes and natural feel. These results align with previous systematic reviews and meta-analyses, which consistently describe IPPs as the most advanced and effective option available [S3], [S4], [S6], [S10], [S13]. In contrast, malleable and one-component rigid implants, while slightly less effective with success rates ranging from 80% to 90%, remain viable and often preferable in LMIC settings due to their lower cost and simpler surgical requirements [S10], [S15]. Notably, unpublished data from Uzbekistan reflected a success rate of 85% with rigid implants, further supporting their utility in resource-constrained environments.

With respect to safety, penile implants demonstrated acceptable complication rates overall. Inflatable devices were associated with higher mechanical failure rates, typically between 5% and 10%, likely due to their mechanical complexity [S4], [S13]. Malleable implants, though more durable, were linked to higher erosion rates in patients with compromised tissue quality [S15], [S16]. Infection rates remained low, especially in high-income countries (HICs), where surgical protocols and follow-up systems are well-established. However, complication rates were generally higher in LMICs, reflecting disparities in surgical expertise, healthcare infrastructure, and postoperative care [S10], [S15].

Patient and partner satisfaction emerged as a major strength of penile implant treatment. Across studies, patient satisfaction rates ranged from 85% to 95%, while partner satisfaction also remained high, often between 80% and 90% [S3], [S7], [S8], [S14]. Improvements in quality of life, self-confidence, and relationship dynamics were frequently reported. Factors such as thorough preoperative counseling, realistic patient expectations, and effective follow-up care significantly influenced these outcomes [S3], [S8], [S12].

These findings have clear implications for clinical practice and healthcare policy. Treatment selection should be individualized based on patient preferences, financial limitations, and the availability of surgical expertise. Inflatable prostheses are ideal in high-resource settings where advanced surgical care and long-term maintenance are accessible. In contrast, malleable or rigid implants are more appropriate in LMICs, where cost and simplicity are critical considerations. Preoperative education remains essential to manage expectations and increase postoperative adherence. Furthermore, improved access in LMICs could be achieved by addressing financial barriers through subsidies or public insurance, as well as by expanding urological training programs to enhance surgical outcomes.

Compared with existing literature, this review contributes uniquely by emphasizing outcomes in LMICs. Most prior studies focus primarily on high-income settings, whereas this review incorporates emerging data from Uzbekistan and similar regions, demonstrating the feasibility and success of rigid implants in low-resource environments. Additionally, by addressing all key outcome domains – effectiveness, safety, and satisfaction – this review provides a more holistic picture than earlier research, which often focuses on only one of these factors. It also deepens the understanding of barriers to access by exploring economic, cultural, and systemic challenges specific to LMICs.

Despite the strengths of this review, several limitations should be acknowledged. The included studies varied significantly in design, population, and outcome reporting, which limited the ability to perform a formal meta-analysis. Most data originated from high-income countries, and there remains a scarcity of high-quality research from LMICs. Furthermore, long-term data on implant performance beyond five years were limited, leaving gaps in our understanding of device durability and late-onset complications.

Future research should prioritize cost-effectiveness analyses comparing implant types in both high- and low-resource settings. Cultural and educational interventions addressing stigma around ED and penile implants could support earlier diagnosis and better treatment uptake. Long-term cohort studies are also needed to assess device reliability, revision rates, and quality of life over extended periods. Additionally, a more detailed investigation into regional disparities, particularly in Central Asia and sub-Saharan Africa, would help inform equitable health policies.

In summary, this review affirms that penile implants are an effective, safe, and satisfying treatment for ED. They offer significant benefits to patients across diverse clinical and geographic settings, and with continued research and healthcare investment, their impact can be further expanded globally.

Conclusion

This systematic review evaluated the clinical effectiveness, safety, and patient satisfaction associated with penile implants in the treatment of erectile dysfunction (ED). The evidence from 18 selected studies, supplemented by unpublished data from Uzbekistan, supports the use of penile prostheses as a reliable and durable solution, particularly for patients who do not respond to pharmacological therapies.

Inflatable penile prostheses (IPPs) demonstrated the highest functional success rates and patient satisfaction outcomes, making them the preferred option in high-resource settings. Malleable and rigid implants, though slightly less effective, remain essential alternatives in low- and middle-income countries (LMICs) where affordability, simplicity, and limited surgical infrastructure must be taken into account. The safety profile of penile implants was generally acceptable across all device types, though complication rates varied depending on implant design, patient characteristics, and regional healthcare conditions.

This review also highlighted significant disparities in access to penile implants between high-income countries and LMICs. Barriers related to cost, surgical expertise, and healthcare infrastructure continue to limit the availability of treatment in resource-constrained settings. Nonetheless, evidence suggests that with appropriate support—including training programs, financial subsidies, and patient education—penile implants can be safely and effectively implemented even in under-resourced regions.

Future research should focus on long-term outcomes, cost-effectiveness analyses, and culturally tailored strategies to improve awareness and reduce stigma around ED treatments. Additionally, more high-quality studies from LMICs are needed to ensure that global treatment guidelines are informed by a broad, representative evidence base.

In conclusion, penile implants offer a highly effective and satisfactory solution for ED, with outcomes that are adaptable across various clinical and regional contexts. With proper investment in healthcare infrastructure and equitable access strategies, their global impact can be significantly expanded.

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The list of references is available at the editorial office

Обзоры

SYSTEMATIC EVALUATION OF PENILE IMPLANTS FOR ERECTILE DYSFUNCTION: A COMPREHENSIVE ANALYSIS OF EFFECTIVENESS, SAFETY, AND PATIENT SATISFACTION

Abbosov Sh.A., Makhmudov A.T., Tulaboev A.K., Aliyev S.U., Shavakhabov Sh.Sh., Akilov F.A.

A comprehensive search of PubMed, Scopus, Web of Science, Cochrane Library and Google Scholar identified 18 peer-reviewed studies that met the inclusion criteria. The findings demonstrate that penile implants are highly effective, with overall success rates ranging from 80-95%: inflatable implants showed the best results (90-95%), while semi-rigid (modifiable) implants were less effective (80-85%). Patient satisfaction was also consistently high (85-95%), with high partner satisfaction (85-90%). The review highlights the need to address existing barriers to ensure equitable global access to penile implants and optimize patient outcomes worldwide.

Key words: *penile implants, erectile dysfunction, patient satisfaction, safety outcomes, low- and middle-income countries, access barriers, non-pharmacological treatments.*

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АРУСТАМОВ ДМИТРИЙ ЛЬВОВИЧ (1942-2025)

11 июля 2025 года в возрасте 83 лет ушел из жизни выдающийся ученый, врач, патриарх урологии, доктор медицинских наук, заслуженный деятель науки Республики Узбекистан, лауреат премии им. Абу Райхана Беруний, кавалер ордена "Дустлик" профессор Дмитрий Львович Арустамов.

В 1959-1966 гг. Д.Л. Арустамов был студентом лечебного факультета Самаркандского государственного медицинского института, в 1966-1968 гг. – стажером-исследователем кафедры общей хирургии СамГосМИ.

В 1968-1972 гг. Д.Л. Арустамов – старший научный сотрудник, руководитель лаборатории иммунопатологии, в 1972-1975 гг. – старший научный сотрудник лаборатории по преодолению тканевой несовместимости ЦНИЛ Ташкентского государственного медицинского института.

В 1975-1979 гг. – проректор по научной работе ТашГосМИ. В 1978-2007 гг. Д.Л. Арустамов возглавлял кафедру урологии ТашГосМИ, в последующем – Ташкентской медицинской академии, в 1990-2006 гг. – директор Республиканского специализированного центра урологии.

Благодаря личному энтузиазму и огромной трудспособности Д.Л. Арустамовым в Узбекистане был организован Республиканский специализированный центр урологии, по ключевым направлениям урологии подготовлены высококвалифицированные кадры, которые обучались в ведущих зарубежных клиниках. В Центре урологии, оснащеннныи медицинским оборудованием передовых производителей, налажен весь необходимый спектр диагностических и лечебных технологий, разработаны и внедрены малоинвазивные хирургические вмешательства в урологии.

Его яркий научный талант, огромный клинический опыт, фундаментальные знания и виртуозные навыки в урологии позволили внедрить в клиническую практику такие передовые методы лечения урологических заболеваний как экстракорпоральная ударно-волновая литотрипсия, перкутанная хирургия нефролитиаза, трансуретральная резекция простаты при ее доброкачественной гиперплазии.

Еще одним важным вкладом в урологию является ряд принципиальных работ, посвященных изучению уродинамики верхних мочевых путей и проблем дисфункции мочеиспускания. Под руководством Д.Л. Арустамова группой единомышленников изучены вопросы дифференциальной диагностики недостаточности мочеиспускания, ятрогенной медикаментозной дисфункции нижних мочевых путей, разработано модифицированное исследование "давление-поток" в оценке функционального состояния мочевого пузыря, упрощенный метод определения контрактильности мочевого пузыря у больных с ДГПЖ, метод эндоуретральной пластики с использованием отверждающихся силиконовых компаундов в лечении недержания мочи при напря жении у женщин, метод исследования профиля внутримочеточникового давления для диагностики обструкции моче-

точника и выбора оптимального метода его лечения. Наиболее значимым вкладом Д.Л. Арустамова в урологию является прогнозирование и оценка способов восстановления фертильности у больных варикоцеле, патогенетическое обоснование дифференциального подхода к лечению варикоцеле, разработка метода рентгеноэндоваскулярной склеротерапии левостороннего варикоцеле, а также совершенствование диагностики и лечения некоторых воспалительных заболеваний мужских половых органов.

Особой заслугой Д.Л. Арустамова является изучение распространенности наиболее значимых урологических заболеваний в регионах Узбекистана, определение внутренних и внешних факторов риска их развития, включая факторы окружающей среды, а также разработка мер профилактики урологических заболеваний.

Профессор Дмитрий Львович Арустамов – автор более 250 научных работ. Научная деятельность Д.Л. Арустамова, являясь многогранной, включала в себя вопросы трансплантации органов и тканей, диагностики и лечения мочекаменной болезни, уродинамики, супра- и инфравезикальной обструкции, уроонкологии и андрологии. Им подготовлено 9 докторов и 45 кандидатов медицинских наук.

Ушел из жизни крупный ученый, блестящий врач, талантливый педагог, незаменимый друг, человек с большой буквы. Невосполнимую утрату понесли наука и медицина Узбекистана, узбекистанская урологическая школа и вся страна. Светлая память о Дмитрии Львовиче Арустамове навсегда останется в наших сердцах.

**Научное общество урологов Узбекистана,
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MUALLIFLAR UCHUN MA'LUMOT
MAQOLALAR FAQAT YUQORIDA KO'RSATILGAN QOIDALARGA QAT'IY RIOYA QILINGAN HOLDA QABUL QILINADI!

QO'LYOZMANI TAYYORLASH QOIDALARI

"Toshkent tibbiyot akademiyasi axborotnomasi" jurnali 2 oyda 1 marta chop etiladi. Jurnalga respublika oliy o'quv yurtlari va tibbiyot markazlari xodimlari, qo'shni davlatlardan kelgan mutaxassislarning maqolalari qabul qilinadi.

Maqola kompyuterda Word dasturida yozilishi kerak. Hoshiyalar: yuqoridan va pastdan 2 sm, chapdan 3 sm, o'ngdan 1,5 sm asosiy shrift Times New Roman, asosiy matnning shrift o'lchami 14, qator oralig'i bir yarim, matnni kengligi bo'yicha tekislash, paragrafning chegarasi (**qizil chiziq**) 1,5 sm.

Sahifani raqamlash amalga oshirilmaydi. Rasmlar matnga kiritilishi, har bir rasmda rasm ostida imzo bo'lishi kerak.

Alifbo tartibida tuzilgan adabiyotlar ro'yxatiga muvofiq kvadrat qavs ichida [1,2] adabiyotlarga havolalar avval rus tilidagi, keyin chet tilidagi manbalar yoziladi. Adabiyotlar ro'yxati Davlatlararo standart talablariga muvofiq tuziladi. Adabiyotlar ro'yxati va maqolada keltirilgan ma'lumotlarning to'g'riligi va ishonchliligi uchun javobgarlik mualliflarga yuklatilgan.

Adabiyotlar ro'yxatini tuzishda quyidagilar ko'rsatiladi: **kitoblar uchun** - mualliflarning familiyasi, bosh harflari, kitob nomi, joyi, nashriyoti, nashr etilgan yili, sahifalar soni; **jurnal maqolalari uchun** - mualliflarning familiyasi va bosh harflari, maqola nomi, jurnal nomi, yil, raqam, sahifalar (- to); **to'plamlardagi maqolalar uchun** - mualliflarning familiyasi va bosh harflari, maqola nomi, to'plam nomi, nashr etilgan joy va yil, sahifalar (- to); **dissertatsiya referatlari uchun** - familiyasi va muallifning bosh harflari, dissertatsiya nomi, doktorlik yoki nomzodlik, nashr etilgan joy, yil, sahifalar soni.

Toshkent tibbiyot axborotnomasi jurnalida: "Yangi pedagogik texnologiyalar" sarlavhalari mavjud. "Sharhlar", "Eksperimental tibbiyot", "Klinik tibbiyot", "Gigiena, sanitariya, epidemiologiya", "Amaliyotchiga yordam", "Yoshlar tribunasi". Maqolalar hajmi **20** bet, foydalanilgan adabiyotlar ro'yxati **40-50** manba. Maqolalarga sharh uchta tilda (**o'zbek, rus, ingliz**) sharh maqolalari 0,3-0,5 sahifadan oshmasligi kerak, kalit so'zlar (**3-5** so'z).

"Eksperimental tibbiyot", "Klinik tibbiyot", "Sanitariya, gigiena, epidemiologiya" (o'z materiali) bo'limlarida nashr etish uchun mo'ljallangan maqolalar hajmi - **9-12** bet, foydalanilgan adabiyotlar ro'yxati - **12-15** manbadan ko'p bo'lmagan, alifbo tartibida. O'z materiallarini o'z ichiga olgan maqolalarga izohlar tuzilgan bo'lishi kerak, ya'ni. o'z ichiga oladi (qisqacha): **maqsad, material va usullar, natijalar, xulosalar, kalit so'zlar**. Ular, shuningdek, uch tilda tuziladi.

Ilmiy maqolani loyihalashga qo'yiladigan umumiy talablar.

Maqolaning boshida, maqola sarlavhalari markazga tekislangan holda qizil chiziqdan ko'rsatilgan:

- Universal o'nlik tasnifi bo'yicha raqam (**UDK**)
- maqola yozilgan tilda maqolaning nomi (**kichik harflar bilan**),
- muallifning familiyasi va bosh harflari,
- ish olib borilgan tashkilotning nomi,

Bundan tashqari, xuddi shu ketma-ketlikda ma'lumotlar uch tilda yoziladi.

Maqolada quyidagilar bo'lishi kerak:

- qisqa kirish (alohida emas),
- **tadqiqotning maqsadi,**
- **materiallar va tadqiqot usullari**
- **tadqiqot natijalari va ularni muhokama qilish**
- **xulosa**

Oxirida muallifning telefon raqamini ko'rsatishi kerak, u bilan tahririyat bilan ish olib borish mumkin bo'lishi ucun.

К СВЕДЕНИЮ АВТОРОВ

СТАТЬИ ПРИНИМАЮТСЯ ТОЛЬКО ОФОРМЛЕННЫЕ В СТРОГОМ СООТВЕТСТВИИ С ПРИВЕДЕННЫМИ ПРАВИЛАМИ!

ПРАВИЛА ОФОРМЛЕНИЯ СТАТЕЙ

Журнал «Вестник Ташкентской медицинской академии» выходит с периодичностью 1 раз в месяц. В журнал принимаются статьи сотрудников вузов и медицинских центров республики, а также специалистов из ближнего зарубежья.

Статья должна быть набрана на компьютере в программе Word. Поля: верхнее и нижнее 2 см, левое 3 см, правое 1,5 см. Основной шрифт Times New Roman, размер шрифта основного текста 14 пунктов, межстрочный интервал полуторный, выравнивание текста по ширине, абзацный отступ (**красная строка**) 1,5 см.

Нумерация страниц не ведется. Рисунки внедрены в текст. Под каждым рисунком должна быть подпись.

Список литературы оформляется согласно требованиям ГОСТ. Источники (**только на языке оригинала**) перечисляются в алфавитном порядке (сначала на русском, затем на иностранных языках). Ссылки на авторов в тексте приводятся в квадратных скобках с указанием их порядкового номера согласно списку [1,2]. Ответственность за правильность и достоверность данных, приведенных в списке литературы, возлагается на авторов.

При составлении списка литературы указываются: для книг - *фамилия, инициалы авторов, название книги, место, издательство, год издания, количество страниц;* ***для журнальных статей -*** *фамилия и инициалы авторов, название статьи, название журнала, год, номер, страницы (от - до);* ***для статей из сборников -*** *фамилия и инициалы авторов, название статьи, название сборника, место и год издания, страницы (от - до);* ***для авторефератов диссертаций -*** *фамилия и инициалы автора, название диссертации, докторская или кандидатская, место издания, год, количество страниц.*

В журнале Вестник ТМА имеются рубрики: *«Новые педагогические технологии». «Обзоры», «Экспериментальная медицина», «Клиническая медицина», «Гигиена, санитария, эпидемиология», «Помощь практическому врачу», «Трибуна молодых».* Объем обзорных статей – **20** страниц, список использованной литературы – **40-50** источников. Объем аннотаций на трех языках (**узбекском, русском, английском**) к обзорным статьям не должен превышать **0,3-0,5** страницы, с ключевыми словами (**3-5 слов**).

Объем статей, предназначенных для публикации в рубриках «Экспериментальная медицина», «Клиническая медицина», «Санитария, гигиена, эпидемиология» (собственный материал) – **9-12** страниц, список литературы – не более **12-15** источников также в алфавитном порядке.

Структура оригинальной статьи должна быть следующей: **введение, материал и методы, результаты и обсуждение, заключение или выводы, список цитируемой литературы**. Таблицы должны иметь заголовок. В тексте следует указать ссылку на таблицу, **повторение приведенных в ней данных не допускается.** Аннотации к статьям, содержащим собственный материал, должны быть структурированными, т.е. содержать (кратко): **цель, материал и методы, результаты, выводы, ключевые слова.** Оформляются также на трех языках.

Общие требования к оформлению научной статьи.

В начале статьи с выравниванием названия статьи по центру указываются с красной строки:

- номер по Универсальной десятичной классификации (УДК)
- название статьи (**строчными буквами**) на том, языке, на котором написана статья,
- фамилия и инициалы автора,
- название организации, в которой выполнялась работа.

Далее в той же последовательности информация приводится на русском и английском языках.

Статья должна содержать:

- краткое введение (не выделяется),
- **цель исследования,**
- **материалы и методы исследования,**
- **результаты исследования и их обсуждение,**
- **заключение,**
- **выводы.**

В конце следует указать номер телефона автора, с которым можно будет вести редакционную работу.