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REVIEW ARTICLE

Ureteral Stent in Kidney Transplantation: Benefits and Risks in the Prevention of Urological Complications

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ABSTRACT

Introduction: Kidney transplantation is the most effective treatment for patients with end-stage chronic kidney disease. However, urological complications, such as ureteral obstruction, may compromise the graft. Ureteral stenting is widely used to prevent these complications, although it is associated with risks such as urinary tract infections and stone formation, raising controversies regarding its actual benefit. **Objective:** To evaluate the impact of ureteral stent use in kidney transplantation and its influence on reducing urological complications. **Methods:** An integrative review was conducted in PubMed and Biblioteca Virtual em Saúde (BVS) databases, including articles in Portuguese and English published from 2015 to 2025, available in full text, and involving adult patients. A total of 20 studies were selected after screening 287 records. Results: National and international publications included systematic reviews, clinical trials, and cohort studies, mainly addressing urinary tract infection, ureteral stenosis, and fistula associated with stent use. **Discussion:** The duration of stent placement showed a direct impact on complications. Early removal, within 14 days, reduced urinary tract infection (UTI) incidence without increasing fistulas or stenosis, while prolonged use favored bacterial colonization. The absence of a stent increased leakage and stenosis rates, confirming its protective role in some scenarios. Double-J stents were associated with a lower risk of severe complications but with a higher UTI incidence. **Conclusion:** Ureteral stenting reduces urological complications in kidney transplantation, but dwell time directly affects the risk of UTI and stenosis. Further studies comparing duration strategies and different stent materials are needed to support safer clinical protocols.

Descriptors: Ureteral Stent; Kidney Transplantation; Surgical Risk; Urological Complications; Postoperative Outcomes.

Stent Ureteral no Transplante Renal: Benefícios e Riscos na Prevenção de Complicações Urológicas

RESUMO

Introdução: O transplante renal é o tratamento mais eficaz para pacientes com insuficiência renal crônica terminal, mas complicações urológicas, como obstrução ureteral, podem comprometer o enxerto. O *stent* ureteral é amplamente utilizado para prevenir essas complicações, embora esteja associado a riscos, como infecção urinária e formação de cálculos, gerando controvérsias quanto ao seu benefício. **Objetivo:** Avaliar o impacto do uso do *stent* ureteral no transplante renal e sua influência na redução de complicações urológicas. **Métodos:** Revisão integrativa realizada nas bases PubMed e Biblioteca Virtual em Saúde (BVS), incluindo artigos em português e inglês publicados de 2015 a 2025 disponíveis em texto completo e envolvendo adultos. Foram selecionados 20 estudos após triagem de 287 registros. Resultados: As publicações nacionais e internacionais abordaram revisões sistemáticas, ensaios clínicos e estudos de coortes, analisando principalmente infecção urinária, estenose e fístula associadas ao uso do *stent*. **Discussão:** O tempo de permanência do *stent* mostrou impacto direto nas complicações. A retirada precoce, até 14 dias, reduziu a infecção do trato urinário (ITU) sem aumentar fístulas ou estenoses, enquanto o uso prolongado elevou a colonização bacteriana. A ausência do *stent* aumentou vazamentos e estenoses, reforçando seu papel protetor. O duplo J associou-se a menor risco de complicações graves, mas com maior incidência de ITU. **Conclusão:** O *stent* ureteral reduz complicações urológicas no transplante renal, mas o tempo de permanência influencia o risco de ITU e estenose. São necessários novos estudos comparando estratégias de uso e diferentes materiais para orientar protocolos mais seguros.

Descritores: Stent Ureteral; Transplante Renal; Risco Cirúrgico; Complicações Urológicas; Resultados Pós-Operatórios.

INTRODUCTION

Kidney transplantation is the treatment of choice for patients with end-stage chronic kidney disease, as it offers better survival and functional outcomes compared to other dialysis methods.[1] Despite advances in surgical techniques, urological complications remain significant postoperative events, especially ureteral obstruction, which can compromise graft function and require additional interventions.[2]

Ureteral stents have been routinely used to reduce mechanical complications associated with ureterovesical anastomosis. The device promotes urinary drainage and reduces the risk of obstruction from edema or ureteral ischemia. However, its use is associated with adverse events such as urinary tract infection (UTI), bacterial colonization, and encrustation, which have generated disagreement regarding its actual impact in the post-transplant period.[3,4]

The analysis of ureteral stent use is particularly relevant in the Brazilian context, which presents a high demand for kidney transplants and heterogeneity in access to specialized centers. Although graft survival in the country is comparable to that of developed countries, structural and healthcare challenges persist that can directly influence surgical outcomes and postoperative management.[5]

Given this scenario, it is necessary to evaluate the relationship between ureteral stent use, device duration, and the occurrence of associated complications. This analysis can support protocol revisions, guide procedures, and contribute to the standardization of care practices. Thus, the objective of this study is to analyze the impact of ureteral stents on the prevention of urological complications in patients undergoing kidney transplantation, considering benefits, risks, and clinical implications.[6,7]

METHODS

Study type

This work employs an integrative review method, an approach that enables the identification, analysis, and synthesis of results from scientific studies with diverse methodological designs, thereby fostering a broader and more critical understanding of a given phenomenon. The review will follow six stages: development of the guiding question; literature search; data collection using a structured instrument; critical analysis of the studies; discussion of the results; and presentation of a synthesis of the most relevant evidence.[8]

Databases and descriptors

The descriptors used to search for articles were selected from the Descritores em Ciências da Saúde/Medical Subject Headings (DeCS/MeSH) platform, a system created to standardize the terms used in indexing scientific documents in the health field. The descriptors chosen for this work were: stent ureteral (ureteral stent), transplante renal (kidney transplantation), risco cirúrgico (surgical risk), and complicações urológicas (urologic complications). Their respective synonyms were also used, such as: stent ureteral (stent ureter and stent urinary), stent duplo J (double-J stent), transplante renal (kidney transplant), risco cirúrgico (surgery risk), fístula urinária (urinary fistula), estenose ureteral (ureteral stenosis), nEnsaio clínico randomizado ose ureteral (randomized clinical nTrial ureteral osis), infecções do trato urinário (urinary tract infections), complicações pós-operatórias (postoperative complications) and complicações do trato urinário (urinary tract complications).

The search and retrieval of articles were carried out in the Biblioteca Virtual em Saúde (BVS) and PubMed databases. The following search strategy was used in the PubMed database: (((((((ureteral stent) OR (ureteral stents)) OR (stent ureter)) OR (stent urinary)) OR (double-j stent)) OR (double-j stents)) AND ((kidney transplantation) OR (kidney transplant))) AND ((surgical risk) OR (surgery risk))) AND (((((((urologic complication) OR (postoperative complications)) OR (urinary fistula)) OR (urinary fistulas)) OR (ureteral stenosis)) OR (ureteral nEnsaio clínico randomizado osis)) OR (urinary tract infections)) OR (urinary tract complications)). In the BVS, the same strategy was applied in English, using the descriptors and their synonyms, resulting in a representative sample of the scientific literature on the subject. The search for articles was completed in April 2025.

Eligibility criteria

For the selection of studies included in this integrative review, eligibility criteria were established that prioritized the relevance of each study to the research's central theme. Articles addressing the use of ureteral stents in patients undergoing kidney transplantation were considered eligible for inclusion, especially those relating this use to possible urological or surgical complications (Table 1).

The search was restricted to articles published in the last 10 years (2015 to 2025) to ensure the evidence was timely and adhered to the most recent protocols. Furthermore, only full-text studies written in Portuguese or English were considered. During the screening, studies that exclusively addressed pediatric populations were excluded, as they presented different

clinical conduct and characteristics compared to the adult population. Case reports, narrative reviews, and articles that, even when dealing with complications in kidney transplantation, did not have a direct relationship with the use of stents were also removed. Duplicate records and articles that, after reading the title and abstract, were found to be outside the scope of the research were also discarded.

Table 1. PICOS.

Element	Suggested definition
P (*Population*)	Adults (≥ 18 years) who underwent kidney transplantation (living or deceased donor)
I (*Intervention*)	Use of ureteral stent (double-J or other)
C (*Comparator*)	Absence of stent or different removal times (≤ 14 days; ≤ 21 days; ≤ 28 days)
O (*Primary outcomes*)	UTI: defined as compatible symptoms + positive urine culture ≥ 10^5 CFU/mL or according to study criteria; urinary fistula — clinical/imaging diagnosis; ureteral stenosis: imaging/clinically confirmed diagnosis.
S (*Study design*)	Randomized clinical trials and observational studies (prospective/retrosp ective cohorts) published from 2015 to 2025.

Source: Elaborated by the authors.

Data synthesis and analysis

After selecting the articles included in this review, a spreadsheet was created to systematically organize the main information from each study. Data such as author, title, year of publication, database consulted, references, risk factors, methodology, main results, epidemiology, country, and main subject of the article were recorded. The use of this tool facilitated comparisons between studies, allowing clearer visualization of the similarities and differences in the results.

With the data properly organized, content analysis was performed, a qualitative approach that allows interpreting the material by identifying core meanings present in the texts. According to Bardin (2016)[9], this analysis occurs in three stages: pre- analysis, exploration of the material, and treatment of the results obtained through inference and interpretation. The application of this methodology enabled a critical reading of the articles, going beyond mere data description and allowing for more in- depth interpretations of the use of ureteral stents in kidney transplantation. From this analytical process, it was possible to identify recurring themes and significant relationships among the studies' findings, which allowed the delimitation of thematic axes to be presented in the next section and the exclusion of articles that did not support our theme. These axes will support the analysis of results, enabling a well-founded discussion of the benefits, risks, and clinical implications of ureteral stent use.

To systematize and facilitate the comparative analysis of the included studies, Table 2 summarizes the main methodological characteristics of the selected publications, including: author, method, level of evidence according to the Oxford classification, degree of recommendation, and relevant observations.

Table 2. Classification of the study material.

Author	Method	Level of evidence (Oxford)	Recommendation level	Observations
Cai et al.[10]	Meta-analysis of five randomized clinical trials	1A	A	Systematic review of randomized clinical trials
Sarier et al.[11]	Prospective (non- randomized) study	2B	B	Prospective without randomization
Ooms et al.[12]	Comparative retrospective study	2B	B	Retrospective observation
Patel et al.[13]	Multicenter randomized clinical trial	1B	A	Classic randomized clinical trial
Asgari et al.[14]	Randomized clinical trial	1B	A	Randomized, single- center
Kroth et al.[15]	Retrospective cohort	2B	B	Cohort study
Barghouthy et al.[16]	Multicenter, single- blind randomized clinical trial	1B	A	Randomized
LaFranca et al.[17]	Systematic review + meta-analysis of randomized clinical trials	1A	A	Robust systematic review
Yahav et al. [18]	Systematic review + meta-analysis of randomized clinical trials	1A	A	Robust systematic review
Oudmaijer et al.[19]	Single-center, randomized clinical trial	1B	A	Randomized
Wang et al. [20]	Systematic review + meta-analysis of randomized clinical trials	1A	A	Robust systematic review

Continue...

Table 2. Continuation.

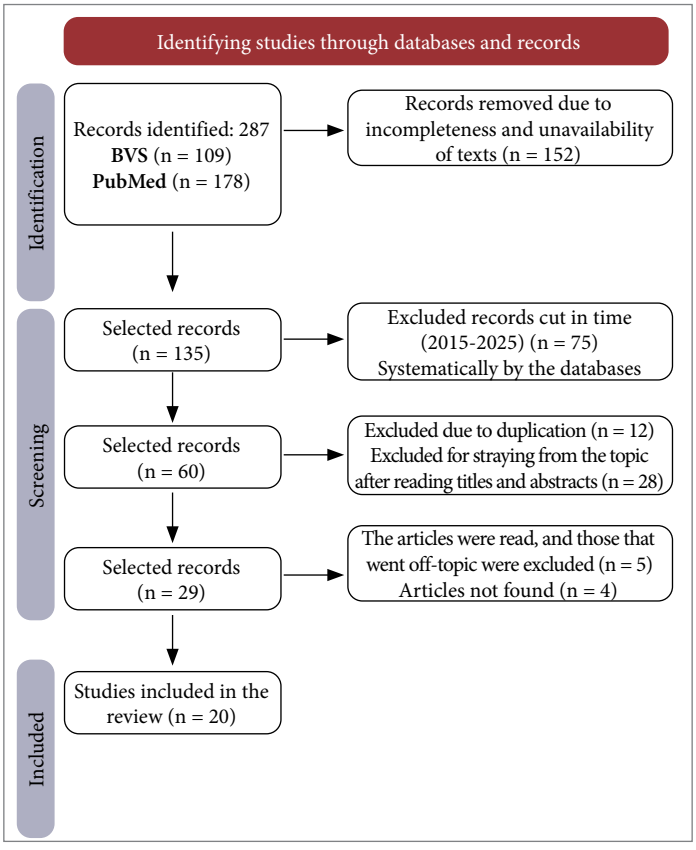
Author	Method	Level of evidence (Oxford)	Recommendation level	Observations
Ciancio et al. [21]	Retrospective cohort (500 patients)	2B	B	Observational study
Lee et al.[22]	Retrospective cohort	2B	B	Observational study
Abrol et al.[23]	Systematic review and meta-analysis of six randomized clinical trials	1A	A	Robust systematic review
Manassero et al.[24]	Retrospective cohort (ureteral complications)	2B	B	Observational study
Bzoma et al.[25]	Comparative retrospective study	2B	B	Observational study
Dadkhah et al.[26]	Randomized clinical trial (529 patients)	1B	A	Randomized
Fockens et al.[27]	Comparative retrospective cohort	2B	B	Observational study
Alci et al.[28]	Retrospective study (three groups: none, primary, secondary)	2B	B	Observational study
Warzyszynska et al.[29]	Retrospective observational cohort (753 patients)	2B	B	Observational study

Source: Elaborated by the authors.

RESULTS

In the identification phase, 287 records were found, 109 in BVS and 178 in PubMed. From there, 12 duplicate records were eliminated. Subsequently, 152 articles were excluded due to the absence of a full text or unavailability for reading. During initial screening, 75 studies were automatically excluded by the databases for not meeting the stipulated time frame (2015-2025), and 28 were discarded for deviating from the theme after reading titles and abstracts.

At the end of this stage, 60 studies were selected for full-text review. Thus, 20 studies comprised the final sample for the review. The screening process is detailed in the flowchart in Fig. 1.



Source: Elaborated by the authors.

Figure 1. Flowchart for selecting study material.

Urinary tract infection

Urinary tract infection (UTI) was the most frequently analyzed complication. Several trials and reviews observed that prolonged ureteral stent placement increased the incidence of UTI. Early removal (≤ 7-14 days or < 3 weeks) was consistently associated with a lower incidence of infection, without an increase in relevant urological complications.

Colonization and bacteriuria rates varied among studies. Stent colonization ranged from 11% to 22.4%, while bacteriuria occurred in approximately 7.4% of cases, with Enterococcus spp. being the most frequent microorganism. Post-removal urinary tract infection (UTI) was observed in 18% of cases, particularly in patients who already had an infection during the device's in- place period. In another study, acute graft pyelonephritis occurred in 15.8% of transplant recipients within the first 30 days.

Factors such as advanced age, longer hospital stay, use of antithymocyte globulin, and the presence of a stent were associated with a higher risk of infection. In a multivariate analysis, ureteral stenting emerged as the only independent predictor of urinary tract infection (UTI), and the presence of UTI was associated with poorer renal function 1 year after transplantation. Prophylaxis with sulfamethoxazole-trimethoprim at the time of stent removal showed a significant reduction in infections.

Ureteral stenosis

The use of ureteral stenting has reduced the occurrence of stenosis in virtually all comparative studies. Patients with stents had a lower need for reoperations and a lower rate of ureteral obstruction, regardless of the time of removal. Clinical trials and systematic reviews have shown that early removal did not increase the incidence of stenosis.

Urinary fistula

The stent also demonstrated a protective effect against urinary fistulas, especially in extravesical anastomoses. Reviews and cohort studies indicated a lower fistula rate in patients who received the device. In a center with high expertise and standardized technique without the use of stents, the complication rate was low (1.4%), suggesting that results without stents depend heavily on surgical experience.

Early versus late removal

The comparison between early and late stent removal showed a consistent pattern: earlier stent removal reduced urinary tract infections, bacterial colonization, and the need for antibiotic therapy, and decreased hospital stay and costs. No relevant differences were observed regarding urinary leakage, stenosis, hydronephrosis, or major urological complications.

Types of stents and usage strategies

The double J stent demonstrated superior performance to the single J stent, with less need for percutaneous nephrostomy, a lower stenosis rate, and better cost-effectiveness. It also showed better results than the suprapubic stent, particularly in total urological complications. Regarding the material, Percuflex™ Plus stents showed less biofilm formation and encrustation compared to silicone stents.

Recent reviews suggest that selective use (in situations of higher surgical risk) may reduce infectious complications without compromising urological safety; however, in many clinical contexts, routine use remains beneficial for preventing stenosis and fistula formation.

In general, studies show that ureteral stents play an important role in preventing urinary stenosis and fistula formation, but their main risk is urinary tract infection (UTI), especially when they remain in place for prolonged periods. Early removal is a safe and advantageous strategy that reduces infections without increasing structural complications. The type of stent, the prophylaxis used, and the center's experience also directly influence the outcomes.

Table 3 summarizes the selected studies, highlighting authors, objectives, methodologies used, and main findings. This arrangement facilitates comparisons across different approaches and the critical interpretation of the evidence.

Table 3. Characteristics of the studies included in the review.

Author	Objective	Method	Results
Cai et al.[10]	To evaluate and discuss the ideal time for removal of ureteral stents after kidney transplantation.	Meta-analysis based on five randomized clinical trials, totaling 568 kidney transplant patients. Early removal of the ureteral stent (≤ 7 days) versus late removal (≥ 14 days) after transplantation was compared. Incidences of urinary tract infections and major urological complications, such as stenosis, obstruction, and ureteral leakage, were evaluated.	Early stent removal was associated with a lower incidence of UTIs, with no significant difference in major urological complications. Furthermore, it showed potential to reduce costs and infection risk, with moderate heterogeneity across studies (I^2 = 50% for complications and I^2 = 36% for UTIs).

Continue...

Table 3. Continuation...

Author	Objective	Method	Results
Sarier et al.[11]	To evaluate the frequency of ureteral stent colonization (USC) and the values of urine cultures in identifying colonizing bacteria, the importance of dwell time for USC in living donor kidney transplant recipients, and the role of the neutrophil/lymphocy te ratio biomarker in USC.	A prospective study was conducted with 107 living kidney transplant recipients, divided according to the duration of stent placement (3rd, 4th, and 5th weeks). Urine and blood analyses (neutrophil/ lymphoc yte ratio) and cultures of the removed stents were performed, evaluating the relationship between stent placement time, colonization, and inflammatory biomarkers.	Stent colonization occurred in 22.4% of patients and bacteriuria in 7.4%, with only 30% of colonizations having a positive urine culture. Colonization was more frequent in the 5th week and less frequent in the 4th week (11%), associated with a higher neutrophil/lymphocy te ratio. *Enterococcus* spp. was the most prevalent microorganism.
Ooms et al.[12]	To evaluate the effects of two types of external ureteral stents on the number of urological complications after kidney transplantation.	This retrospective study of 366 kidney transplants performed from January 2013 to January 2015 was divided into two groups according to the type of external stent used: type A (n = 197) and type B (n = 169). The study assessed the need for percutaneous nephrostomy, urinary tract infection, acute rejection, stent- related complications, surgical reinterventions, graft function, and survival.	The need for percutaneous nephrostomy was greater with type A stents, while urinary tract infection and acute graft rejection were more frequent with type B stents. There was no difference between the groups regarding graft function or survival, and both groups presented similar rates of early removal (< 8 days) and complications such as obstruction, migration, or the need for ureteral reimplantation.
Patel et al.[13]	To compare the benefits and complications of early and late stent removal after surgery.	A randomized clinical trial with 227 kidney transplant recipients in six centers in the United Kingdom, comparing early (5th day) versus late (6 weeks) stent removal. Stent-related complications were assessed for up to 3 months, as well as secondary outcomes such as major complications, quality of life, length of hospital stay, and need for anesthesia.	The rate of stent- related complications was lower in the early removal group, as was the incidence of urinary tract infections (UTIs). Symptoms such as pain, hematuria, and migration occurred only in the late removal group, while quality of life was superior in the early group at week 6. The use of general anesthesia for removal was more common in the late group. Major urological complications were slightly more frequent in the early group, without statistical
Asgari et al.[14]	To compare the benefits and complications of early and late removal of the ureteral stent after surgery.	A prospective trial with 91 kidney transplant recipients randomized to stent removal at 10, 20, or 30 days. One month after removal, they were evaluated by ultrasound, urine culture, and serum creatinine, analyzing complications such as urinary tract infection (UTI), hydronephrosis, urinoma, and perirenal collections.	Early stent removal (10 days) did not increase complications compared to 20 or 30 days. There was a reduction in UTIs after removal, with no significant differences in hydronephrosis, urinoma, fluid collections, or serum creatinine. In addition, early removal reduced the length of hospital stay and hospital costs.
Kroth et al.[15]	To evaluate the incidence, risk factors, and survival outcomes associated with acute graft pyelonephritis in the 30 days following kidney transplantation.	This retrospective cohort study included 708 kidney or kidney-pancreas transplant recipients after excluding early losses. Patients with and without acute graft pyelonephritis in the first 30 days were compared, evaluating clinical characteristics, stent use, rejection, infections, length of hospital stay, and renal function. The analysis included a multivariate model and Kaplan-Meier curves for survival.	The prevalence of acute graft pyelonephritis in the first 30 days was 15.8%. The main risk factors were ureteral stent use, advanced age, length of hospital stay, and use of antithymocyte globulin. *Escherichia coli* was the most frequent causative agent, followed by *Enterococcus faecalis* and *Klebsiella pneumoniae*. Although renal function was worse in patients with pyelonephritis, without statistical significance, graft survival and patient survival were significantly lower.
Barghouthy et al.[16]	To explore the risk of encrustation and biofilm formation in silicone ureteral stents compared to Percuflex™ Plus polymer stents, through a randomized multicenter study.	A prospective, randomized, multicenter, single- blind, comparative study involving 141 patients treated for kidney stones via flexible ureteroscopy. Participants were randomized.	After removal, stents from two groups were analyzed: silicone and Percuflex™ Plus. The average dwell time was similar between them. However, greater biofilm formation and greater mineral encrustation were observed in the Percuflex™ Plus stents compared to the silicone stents.
LaFranca et al.[17]	To evaluate the ideal timing for ureteral stent removal after kidney transplantation, comparing the effects of early removal (less than 3 weeks) with late removal (more than 3 weeks) on urological complications such as urinary tract infection (UTI), urinary leakage, and ureteral stricture.	Systematic review and meta-analysis of seven randomized clinical trials, conducted according to PRISMA guidelines. Studies comparing early removal (≤ 3 weeks) with late removal (> 3 weeks) of the ureteral stent in patients undergoing kidney transplantation were included.	Early stent removal before 3 weeks was associated with a lower incidence of urinary tract infection. However, there was no significant difference in urinary leakage or ureteral stricture when compared to late removal.

Continue...

Table 3. Continuation...

Author	Objective	Method	Results
Yahav et al. [18]	To evaluate the impact of early (< 14 days) versus late (≥ 14 days) removal of the double J stent in patients undergoing kidney transplantation, focusing on the prevention of urinary tract infections and urological complications.	Systematic review and meta-analysis of randomized clinical trials comparing stent duration of < 14 days with ≥ 14 days.	Early stent removal, within 14 days, was associated with lower rates of urinary tract infection and ureteral stricture. Regarding major urological complications, there was no significant difference between early and late removal.
Oudmaijer et al.[19]	To compare the effectiveness of two types of ureteral stents in patients undergoing kidney transplantation: the long-term double J stent and the short- term single J stent.	This prospective, randomized, single- center study was conducted from November 2018 to August 2023 with 300 patients who underwent kidney transplantation. Participants were randomly assigned to receive either a double J stent or a single J stent, with removal according to the respective protocols. The primary outcome was the need for percutaneous nephrostomy within 6 months.	The use of the double J stent was associated with a lower need for percutaneous nephrostomy compared to the single J stent. Multivariate analysis confirmed this association, and it was estimated that 10 patients treated with the double J stent would be needed to prevent one percutaneous nephrostomy. The other outcomes were similar between the groups, but length of hospital stay and cost-effectiveness favored the double J stent.
Wang et al.[20]	To explore the ideal time for ureteral stent removal after kidney transplantation.	Systematic review and meta-analysis of seven randomized clinical trials, following PRISMA, with searches in PubMed, Embase, and Cochrane. Two independent reviewers selected studies, extracted data, and assessed risk of bias. Patients undergoing kidney transplantation were included, comparing early (≤ 3 weeks) versus late (> 3 weeks) ureteral stent removal.	Early removal of the ureteral stent has proven effective in significantly reducing the risk of urinary tract infection, without increasing the incidence of complications such as urinary leakage or stenosis. These findings indicate that prolonged stent placement favors the occurrence of UTI, with the period of 14 to 21 days considered the most appropriate for removal.
Ciancio et al.[21]	To describe the results of applying a modified extravesical ureteroneocystosto my technique, without the use of a ureteral stent, in 500 consecutive kidney transplant recipients, focusing on the reduction of urological complications and descriptive comparison with techniques previously reported in the literature.	Retrospective cohort study of 500 consecutive patients who underwent kidney transplantation at a tertiary hospital, all operated on by the same surgeon using a modified extravesical technique, without the use of stents. Follow-up was 12 months, evaluating urological complications.	In the 12-month follow-up after transplantation, only 1.4% of patients experienced urological complications when the stent was not used routinely, a result considered excellent according to the literature. Furthermore, no patient required surgery solely for device removal. The incidence of urinary tract infection (UTI) in this group was 11.2%, with recurrent infection in only 2.6%, possibly related to the absence of systematic stent use.
Lee et al.[22]	To investigate whether antibiotic prophylaxis for stent removal was associated with a reduction in the incidence of urinary tract infections (UTIs).	Retrospective cohort study with 277 kidney transplant recipients who underwent stent removal. Patients were divided into those who received additional antibiotics at the time of removal (n = 56) and those who did not (n = 221). The incidence of urinary tract infection (UTI) up to 4 weeks was analyzed by logistic regression to identify associated factors.	It was observed that 18% of patients developed a urinary tract infection (UTI) within four weeks after stent removal. The presence of infection during the period the device remained implanted significantly increased the risk of subsequent infection. Conversely, prophylaxis with sulfamethoxazole-trimethoprim was associated with a significant reduction in this risk.
Abrol et al.[23]	Review all published randomized controlled clinical trials to examine the role of prophylactic stent implantation in preventing serious urological complications in kidney transplants with extravesical ureteroneocystosto my.	Systematic review and meta-analysis of six randomized clinical trials, according to PRISMA, including only studies with the extravesical ureterovesical anastomosis technique (Lich- Gregoir). Patients with and without stents were compared using a random-effects model and the Cochran-Mantel- Haenszel test.	Urinary leakage was more frequent in patients without stents, although without statistical significance. The incidence of urinary tract infections (UTIs) was considerably higher in patients with stents, demonstrating that routine use of the device has a limited role in preventing complications such as fistula or obstruction, but significantly increases the risk of infection. In these situations, early removal is recommended when necessary.
Manassero et al.[24]	To retrospectively evaluate a series of kidney transplant patients who developed ureteral complications (stenoses or fistulas) and, based on this experience, provide guidance on the most appropriate minimally invasive approach to reduce the need for surgical reintervention and the risk of graft loss.	Retrospective cohort study, conducted at a single center (University of Pisa). 838 transplant patients from 2000 to 2012 were analyzed, with evaluation of the incidence, treatment, and outcome of 24 urological complications (six fistulas and 18 stenoses).	Overall incidence of urological complications: 2.6%. Initial treatment with double J stent was successful in 75% of cases approached retrogradely. Antegrade approach was successful in 50% of cases. There were three graft losses (none due to direct urological complication). Minimally invasive approaches avoided surgery in 45.8% of cases.

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Table 3. Continuation.

Author	Objective	Method	Results
Bzoma et al.[25]	To evaluate the influence of ureteral stenting in the prevention of urological complications (such as urinary fistula and ureteral stenosis) and its relationship with urinary tract infection in kidney transplant recipients.	This was a retrospective, observational, comparative study. 628 transplanted patients from 2011 to 2016 were included. Two groups were compared: one with a double J stent (n = 502) and one without a stent (n = 126), both with extravesical ureteroneocystosto my (Lich-Gregoir technique). Outcomes assessed included: urinary fistula, ureteral stenosis, lymphoceles, urinary tract infection (UTI), and need for reoperation.	Stent placement significantly reduced urinary fistula and ureteral stenosis, as well as the need for reoperation. Although UTI was more frequent in the stent group, this difference was not significant, possibly due to the use of prophylactic antibiotics and early removal. The stent was not an independent predictor of UTI, and the overall rate of urological complications was 6.2%.
Dadkhah et al.[26]	To evaluate the benefits and complications of ureteral stent removal at different time points (10, 20, and 30 days) after kidney transplantation.	Randomized clinical trial. 529 transplanted patients from May 2011 to August 2014 were randomly divided into three groups according to the time since stent removal (10, 20, and 30 days). Pre- and post-removal evaluation with creatinine, urine culture, and ultrasound. Patients with clinical confounding factors were excluded.	There was no statistically significant difference between the groups regarding the occurrence of urological complications (hydroureter, urinoma, collections). Early stent removal (10 days) did not increase complications.Reduction in the rate of UTI and need for readmission. The procedure was safe and cost-effective.
Fockens et al.[27]	To compare the impact of internal double J stents versus external suprapubic stents on urological complications, urinary tract infection, and graft function in kidney transplantation.	This retrospective cohort study included 419 patients who underwent kidney transplantation from deceased donors between 2008 and 2013. The use of internal stents (JJ, n = 236) was compared with suprapubic external stents (n = 183), both with ureterovesical anastomosis using an extravesical technique. The incidence of urological complications, urinary tract infection, graft function, and surgical revision rate were analyzed.	The use of a double J (internal) stent was superior to a suprapubic (external) stent in preventing ureteral stenosis and total urological complications, with statistical significance. The urinary tract infection rate was high in both groups, with no difference between them. The group with the JJ stent had more patients with obesity, diabetes, and graft dysfunction, which may explain the slightly lower estimated glomerular filtration rate (eGFR). Even with more clinical risk factors, the JJ group had fewer major urological complications, reinforcing the preventive efficacy of the internal stent.
Alci et al.[28]	To investigate the relationship between the use of double J stents and demographic characteristics, surgical complications, urinary tract infection, and hematuria in patients undergoing kidney transplantation.	Retrospective study with 331 transplanted patients from 2008 to 2011. Patients were divided into three groups: without stent (n = 254), with primary stent (n = 52) and with secondary stent (n = 25). Surgical complications, urinary tract infection, positive blood cultures, need for reoperation and other clinical variables were evaluated.	The incidence of urinary tract infections (UTIs) was higher in patients with stents, as were surgical complications, reoperations, positive blood cultures, and hematuria. Stents were more frequently used in higher-risk patients or deceased donors, which explains some of the differences. Even so, both primary and secondary stent placement were associated with worse outcomes, suggesting that routine use of the device may not be necessary and should be restricted to specific cases.
Warzyszynska et al.[29]	To evaluate the correlation between double J catheter placement, the incidence of early urinary tract infection, and renal graft function 1 year after transplantation.	This was a retrospective observational study of 753 patients who underwent kidney transplantation from deceased donors between 2010 and 2017. Patients with and without early urinary tract infection (UTI) were compared. The presence of a ureteral stent, renal function on days 30 and 360, previous donor eGFR (modification of diet in renal disease and hypothetical heGFR model), and linear and multiple regressions were analyzed to assess the association between clinical variables and graft outcome.	Early-onset urinary tract infection (UTI) occurred in 31.8% of patients. Stent placement doubled the risk of UTI. Renal function (eGFR) was significantly lower in the UTI group, both on day 30 and day 360 ($p < 0.01$). Ureteral stenting was the only independent predictor of UTI in the multivariate analysis. UTI was associated with lower renal function after 1 year.

Source: Elaborated by the authors.

DISCUSSION

The findings of this review indicate that ureteral stents play a relevant role in preventing mechanical urological complications, especially urinary fistula and ureteral stenosis, particularly in extravesical anastomoses. The consistency of this effect across studies with different designs reinforces the usefulness of the device as an adjunct to surgical safety.

However, the duration of stent placement is a key determinant of the risk of urinary tract infection (UTI) and bacterial colonization. Recent evidence shows that prolonged placement significantly increases these outcomes, possibly due to biofilm

formation and bacterial ascension. In this context, early removal has become an effective strategy, as it reduces the incidence of infections without increasing the rate of mechanical complications, such as urinary extravasation or ureteral stenosis.

A comparative analysis of different types of stents demonstrates that internal devices, such as the double J stent, have a lower frequency of major urological complications than external models. Despite this, the higher infection rate associated with the double J stent, especially when left in place for long periods, should be considered. The stent material also influences the risk of encrustation, although data on this topic remain heterogeneous.

Positive results observed in centers that do not routinely use stents, provided they are associated with highly standardized extravesical techniques and high surgical volumes, suggest that the success of selective strategies strongly depends on institutional expertise. These findings are not necessarily generalizable to all services.

Among the limitations of the included studies, the following stand out: variability in diagnostic criteria for infection and stenosis, methodological heterogeneity, differences in removal protocols, and a predominance of observational designs. These factors hinder direct comparison between studies and limit the development of universal recommendations. Even so, studies converge on the need to balance the mechanical benefits of stents with the infectious risks associated with their prolonged use.

CONCLUSION

This review demonstrated that ureteral stents in kidney transplant recipients reduce urological complications, although the duration of device placement directly affects the incidence of urinary tract infections (UTIs), urinary fistulas, and ureteral stenosis. Despite the favorable results, methodological heterogeneity, lack of standardized outcomes, and diversity of study designs limit the generalizability of the findings.

Thus, the importance of conducting new, more specific research is reinforced, comparing not only the use and duration of placement, but also the different stent materials available, to support safer and more precise clinical recommendations in kidney transplant practice.

CONFLICT OF INTEREST

Nothing to declare.

AUTHOR'S CONTRIBUTION

Substantial scientific and intellectual contributions to the study: Bessa Júnior J, Macedo TJA, Lucena MVS, Pastor ALS, Santana RM, Silva JPC. **Conception and design:** Pastor ALS, Lucena MVS. **Data analysis and interpretation:** Santana RM, Lucena MVS, Silva JPC, Pastor ALS, Macedo TJA. **Article writing:** Lucena MVS, Pastor ALS, Santana RM.**Critical review**: Macedo TJA, Pastor ALS, Santana RM, Lucena MVS. **Final approval:** Santana RM, Lucena MVS.

DATA AVAILABILITY STATEMENT

All data were generated or analyzed in this study.

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DECLARATION OF USE OF ARTIFICIAL INTELLIGENCE TOOLS

The authors declare that artificial intelligence tools were used exclusively for linguistic revision and grammatical correction of the text, and were not employed for the elaboration of scientific content, data interpretation, critical analysis, or formulation of conclusions. The authors bear full responsibility for the content of the article. For the methods section (or equivalent section): artificial intelligence tools were used exclusively to support linguistic revision and grammatical correction of the text, without interfering in the methodological conduct of the study or in the critical analysis of the literature; for the abstract: artificial intelligence tools were used exclusively for linguistic revision of the manuscript.

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