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Renal Transplant and Reconstructive Surgery

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Article info

Keywords:

Renal transplant
Bladder augmentation
Reconstructive surgery

Abstract

Not many years ago, children with structural or functional abnormalities of the lower urinary tract were considered to be very high-risk recipients and were denied renal transplant (RT). However, the development of novel surgical reconstructive techniques (eg, augmentation cystoplasty, Mitrofanoff and Monti techniques) has improved these RT outcome for these patients. Nevertheless, some concerns have been raised that bladder augmentation in these patients may increase the risk of complications, predominantly urinary tract infections (UTIs), urologic complications, bladder cancer, and allograft dysfunction and loss. However, the higher incidence of UTIs in these patients is more related to clean intermittent catheterization noncompliance or vesicoureteral reflux to the native kidney or graft than to the augmented bladder itself and usually does not lead to impairment of graft function. Despite these possible complications and the fact that our current knowledge is based on studies with limited numbers of patients, children who have undergone reconstructive surgeries can be transplanted with an outcome in graft function and survival that is similar to those with normal bladders.

Patient summary: Despite possible complications and the fact that our current knowledge is based on studies with limited numbers of patients, children who have undergone reconstructive surgeries for structural or functional abnormalities of the lower urinary tract can be transplanted with an outcome in graft function and survival similar to those with normal bladders.

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1. Introduction

End-stage renal disease (ESRD) in a child is an irreversible disease with important repercussions on psychomotor, neurocognitive, growth, and social development. Among the different therapeutic options for treating a child with ESRD, renal transplant (RT) is the treatment of choice because it allows renal function recuperation and offers a better quality of life than any type of dialysis. Graft outcome is better with living rather than deceased donors.

Approximately 20% of children with ESRD have a structural or functional urologic abnormality in the lower urinary tract (eg, prune belly syndrome, neuropathic bladder, posterior urethral valve [PUV], or bladder agenesis) that is responsible for their condition. Just as it may lead to the destruction of their native kidneys, it may also adversely affect graft function and survival [1].

For many years these patients were not transplanted because they were considered very high-risk recipients, but in the past few decades, the improvements in knowledge

<http://dx.doi.org/10.1016/j.eursup.2016.08.002>

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and management of lower urinary tract dysfunction as well as the development of novel surgical reconstructive techniques have allowed these patients to be included in RT programs. However, some concerns have been raised regarding the outcome of RT in pediatric patients. Reconstructive surgeries such as augmentation cystoplasty (AC) or a Mitrofanoff procedure might increase the risk of complications, predominantly urinary tract infections (UTIs), urologic complications, bladder cancer, and allograft dysfunction and loss.

Studies evaluating RT outcome in these patients [1–4] have had contradictory results, and current knowledge is based on studies with a limited number of patients with a wide variety of lower urinary tract abnormalities.

2. Pretransplant evaluation

The challenge for the pediatric urologist is to ensure that the damage done to the native kidneys will not be repeated in the transplanted kidney because it is unacceptable to lose a renal graft due to the same processes that contributed to the ESRD. Therefore, before RT all the structural anomalies that might produce bladder dysfunction in these patients must be corrected.

In those patients in whom bladder dysfunction was not diagnosed until renal failure, pretransplant evaluation and surgery are needed to prepare an adequate urinary reservoir with good capacity, compliance, and emptying. To protect the future graft, the bladder must be an adequate low-pressure reservoir and the patient must be able to empty the bladder adequately.

A voiding cystourethrogram is necessary, especially when there is a history of UTIs and lower urinary tract surgical interventions. The urodynamic study can accurately measure variables concerning bladder capacity and compliance, detrusor muscle stability, characteristics of bladder contraction during voiding, amount of postvoid residual, and urine leakage. The videourodynamic study will show, in addition to the features analyzed in the conventional urodynamic study, the existence of vesicoureteral reflux (VUR) and the anatomy of the bladder neck, urethra, and sphincter.

In anuric patients with a defunctionalized bladder or a vesicostomy, the bladder must be cycled for at least 1 wk with either a suprapubic urethral catheter or a button gastrostomy device before bladder urodynamic behavior can be studied. Cycling the bladder allow the clinician to distinguish between potentially reversible abnormalities and those that will not resolve without surgical intervention. In general, if bladder capacity and voiding were normal before a patient developed anuria, they will be normal after transplant.

Indications for removing the native kidneys before RT are severe hypertension, massive proteinuria, recurrent UTIs, and a high-grade VUR. However, it must always be taken into consideration that leaving a native kidney that produces some urine makes dialysis easier and is a potential source of water excretion if the graft fails. In patients on peritoneal dialysis, a retroperitoneoscopy nephrectomy is

the optimal approach for small kidneys and a posterior open nephrectomy for large kidneys.

Children with prune belly syndrome and ESRD usually have bladders with a large capacity and low pressure that are unlikely to impair ureteric graft drainage, but they can have voiding problems and need to empty their bladders by clean intermittent catheterization (CIC) or a Mitrofanoff conduit (if CIC is difficult or painful through the urethra).

Bladder agenesis is a rare cause of ESRD (most frequently due to a bilateral extravesical ureteral ectopia of simple kidneys), and before RT these patients require the construction of a continent diversion using an intestinal segment. To preserve patient body image and self-esteem, a continent diversion is always preferable to an incontinent diversion in these patients, which would only be an option in poorly motivated patients or in those unable to perform CIC.

Patients with poorly compliant bladders due to neuropathy or PUVs who did not respond satisfactorily to anticholinergic therapy need to undergo AC.

3. Augmentation cystoplasty

The goal of AC is to improve bladder function by creating a low-pressure reservoir that will protect the future transplanted kidney graft from high filling pressures. Despite many attempts to identify urodynamic parameters that can help predict the need for AC, this point unfortunately remains open to individual interpretation.

The criterion we use in the decision to augment the bladder is when despite anticholinergic therapy, the urodynamic study shows a linear increase of detrusor pressure during filling with a detrusor pressure >20 cm of water for an estimated bladder capacity <60% (Fig. 1).

Once we are sure the bladder needs to be augmented, the question is when it should be done. RT and AC are both major operations associated with significant morbidity, and there is still some controversy about which surgery should be done first because each approach has its advantages.

Most authors advise performing AC before RT because if a poorly compliant bladder has contributed to ESRD in the native kidneys, it makes sense to correct compliance before transplant and thus provide the best possible environment for the future graft.

Different studies have demonstrated that patients undergoing AC before RT achieve excellent transplant outcomes and have fewer UTIs and ureteral complications than patients in whom RT precedes AC [5,6].

When AC is performed before RT and the patient is anuric, a daily bladder irrigation protocol with saline solution must be established, both to maintain adequate bladder volume while the patient is awaiting transplant as well as to remove any enteric secretion and so decrease the incidence of stones and infections in bladders augmented with intestine.

The main objection to a simultaneous AC and RT is that the steroid-based immunosuppression that follows transplantation would inhibit wound healing and increase tissue fragility, thus increasing the incidence of postoperative

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