

Original Article

Technical Modifications of Ureteroneocystostomy in Renal Transplantation: An 18-year Experience

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ABSTRACT. The treatment of choice for patients with end-stage renal disease is renal transplantation. Urinary tract reconstruction is usually done by anti-reflux ureteroneocystostomy, of which there are several techniques. In this study, a comparison of previous studies related to complications and outcome of various extra-vesical ureteroneocystostomy techniques that were used in our center was made. From the year 1988, when renal transplantation was first performed in our center, we utilized many ureteroneocystostomy techniques including Lich-Grigoir, Barry, Tagochi, and finally Barry-Tagochi. With each conversion, we compared the results of the earlier technique with the new one. In addition, we collected the results of four previous studies conducted by our surgeons and analyzed the complications seen with ureteroneocystostomy. A total of 717 renal transplant recipients were included in our study; 214 of these patients were re-implanted by the Barry-Tagochi technique, 155 cases by the Barry technique, 44 cases by the Tagochi technique, and finally, 304 cases by the Lich-Grigor technique. There was no significant difference in the overall complications, urinary leakage and ureteral stenosis, and obstruction between the four groups. However, complicated hematuria was significantly more frequently seen in the Tagochi group ($P = 0.002$). Also, the mean time taken for ureteroneocystostomy was longer in the Lich-Grigor group ($P = 0.001$). We found that the Barry-Tagochi technique had an overall incidence of urological complications similar to that of the other extravesical techniques and was less time consuming.

Introduction

The treatment of choice for patients with end-
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stage renal disease is renal transplantation. Despite improvements in peritoneal dialysis and hemodialysis, these patients survive much longer after receiving a kidney transplant. Survival rates have improved because of refined surgical techniques and more effective immunosuppression.¹

Urinary tract reconstruction is usually performed by anti-reflux ureteroneocystostomy, of which there are several techniques. Most surgeons prefer the extra-vesical rather than

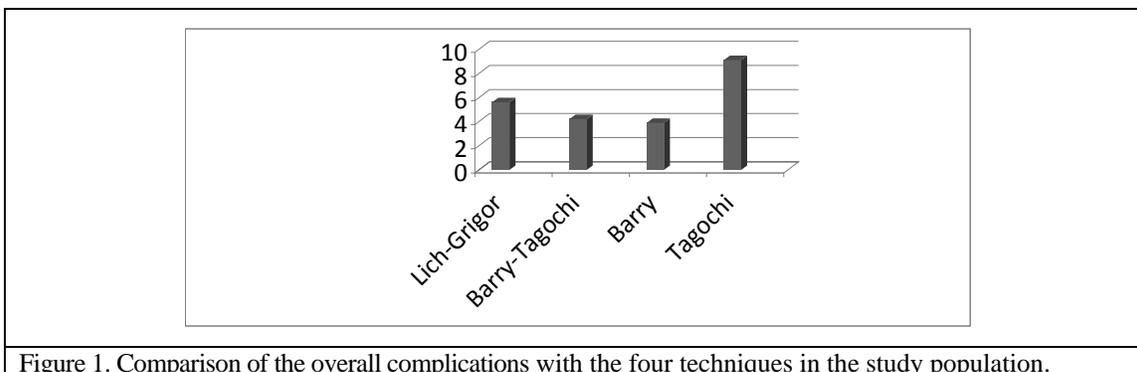


Figure 1. Comparison of the overall complications with the four techniques in the study population.

the trans-vesical approach for ureteroneocystostomy because it is faster, a separate cystotomy is not required and lesser ureteral length is required, thus ensuring adequate distal ureteral blood supply.²

At our center, the Lich-Grigor technique was used for several years with results similar to those reported by others. In 1993, we changed to the extra-vesical technique described by Barry because it proved to be simple and successful. We are using the Barry-Tagochi technique (new technique) for ureteral reimplantation from 2003 onwards.

In this study, a comparison was made of previous studies that were conducted in our center. Additionally, a general view of changing trends in ureteroneocystostomy techniques in our institute is presented.

Material and Methods

From the year 1988, when renal transplantation was first performed in our center, we utilized many ureteroneocystostomy techniques such as Lich-Grigor, Barry, Tagochi, and finally Barry-Tagochi. With each conversion in technique, we compared the results of the previous technique with the new one.

The first study was conducted between 1994 and 1998. In this study, 261 patients were enrolled. Ureteroneocystostomy was performed by the Lich-Grigor technique in 204 cases and by the Barry technique in 57 cases. In these two groups of patients, complications such as urinary leak, ureteral stenosis, and obstruction and reflux over one year of follow-up was investigated.³

In the second study, which was conducted between March 2003 and August 2004, 144 cases were included. In 100 cases, ureteral implantation was made by the Lich-Grigor technique and in 44 cases, by the Tagochi technique. In this study, an assessment was made of ureteral reimplantation time as well as frequency of occurrence of urinary leak, ureteral stenosis and obstruction, and complicated hematuria during 8-12 months of follow-up.⁴

In the third study conducted between September 2004 and September 2005, a new technique which was introduced by Caparrós J in 1993 was used. A total of 114 cases were reimplanted by this technique. In this group also, the ureteroneocystostomy time and complications such as urinary leak, ureteral stenosis and obstruction, and complicated hematuria were evaluated.⁵

In the last study, which was conducted between September 2004 and March 2007, 198 cases were included and were randomly divided into two groups; 100 cases underwent reimplantation by the Barry-Tagochi technique and 98 cases by the Barry technique. In these two groups also, the frequency of occurrence of complications as well as the reimplantation time were estimated during a mean follow-up period of 12 months.⁶

Finally, we compiled the results of all previous studies in a single study in which we assessed and compared the complications and reimplantation time. Statistical analysis was made using the Chi-square test; the Microsoft SPSS software was used for our analysis.

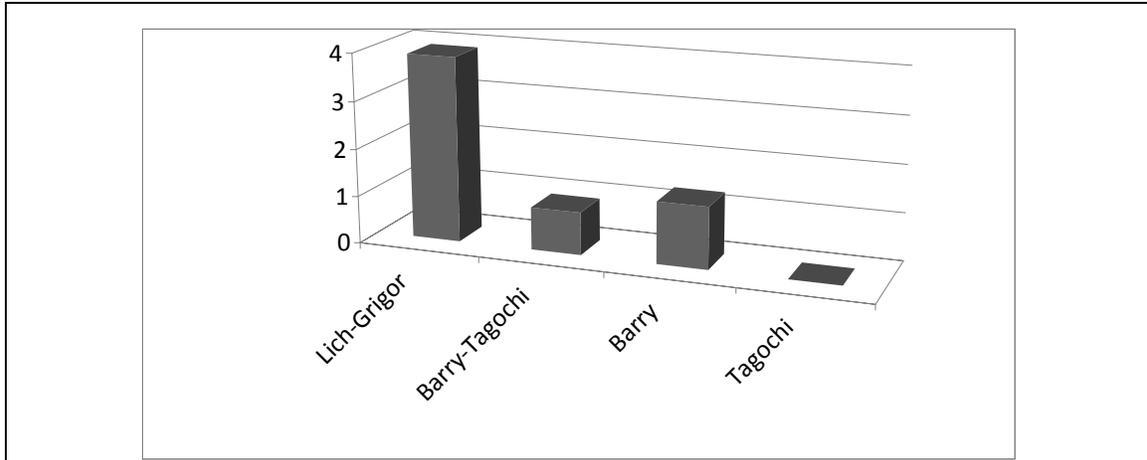


Figure 2. Comparison of urinary leak with the four techniques in the study population.

Results

After including cases of all the studies, a total of 717 renal transplant recipients were included in this analysis. Of these cases, 214 were reimplanted by the Barry-Tagochi technique, 155 cases by the Barry technique, 44 cases by the Tagochi technique, and 304 cases by the Lich-Grigor technique.

The complications that were assessed in our study were urinary leak, ureteral obstruction and stenosis, and complicated hematuria. These complications were analyzed in all studies. Additionally, the ureteric reimplantation time was estimated in all studies. In the Barry-Tagochi, Lich-Grigor, and the Barry groups, some cases were selected randomly and reflux into the reimplanted ureter was assessed by voiding cystourethrogram (VCUG).

With the knowledge that the complications studied always occur in the first two months after surgery, the mean follow-up period in all the groups were longer than two months and this time was suitable for all groups. All surgeries were performed by two transplant surgeons in our center.

Overall, complications after surgery were seen in seventeen patients (5.6%) in the Lich-Grigor group, four (9.1%) in the Tagochi group, six (3.9%) in the Barry group, and nine (4.2%) in the Barry-Tagochi group. No significant difference was found between these groups in the frequency of occurrence of complications ($P = 0.482$) (Figure 1).

Urine leak after ureterneocystostomy was seen in 12 patients (3.9%) in the Lich-Grigor group, none (0%) in the Tagochi group, two (1.3%) in the Barry group, and in two patients

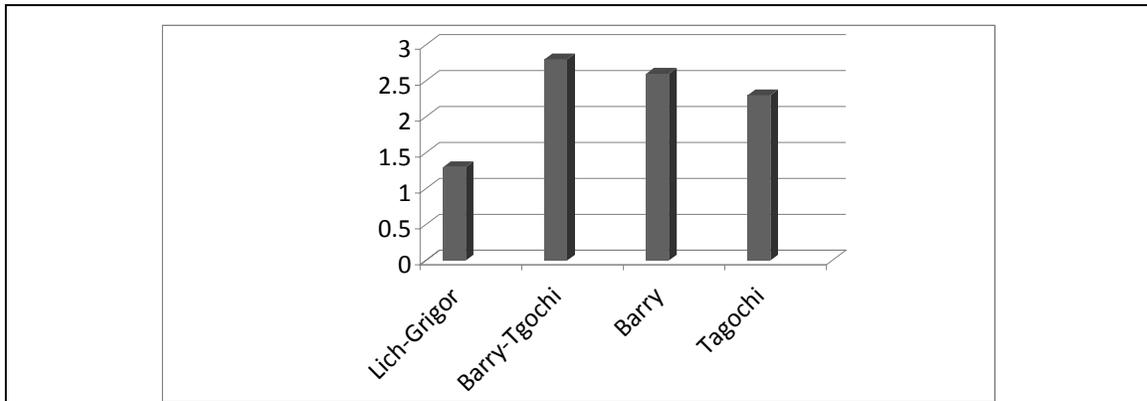


Figure 3. Comparison of ureteral stenosis and obstruction with the four techniques in the study population.

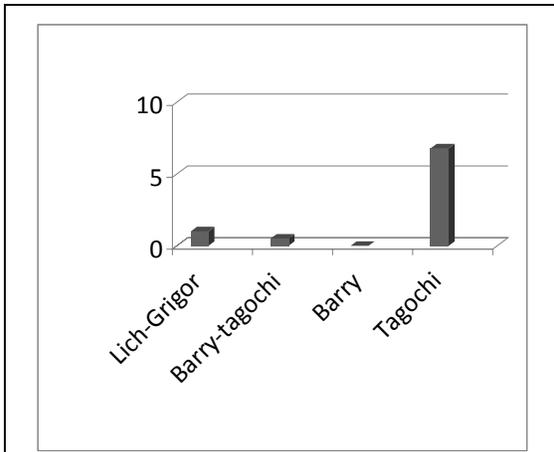


Figure 4. Comparison of complicated hematuria in the study population.

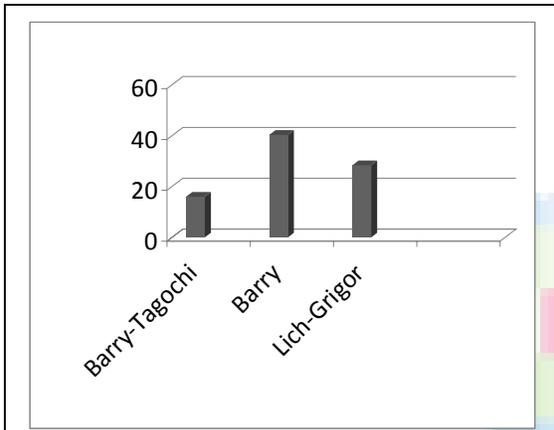


Figure 5. Comparing of incidence of reflux in the re-implanted ureter in the study population.

(0.9%) in the Barry-Tagochi group. Statistical analysis did not reveal any significant difference between these groups ($P = 0.061$) (Figure 2). Ureteral obstruction and stenosis after ureteroneocystostomy was seen in four patients (1.3%) in the Lich-Grigor group, one (2.3%) in the Tagochi group and in four patients (2.6%) in the Barry group ($P = 0.657$) (Figure 3). Complicated hematuria after ureteroneocystostomy was seen in one patient (1%) in the Lich-Grigor group, three (6.8%) in the Tagochi group, none (0%) in the Barry group, and in one patient (0.5%) in the Barry-Tagochi group. Statistical analysis did not reveal any significant difference between the groups studied ($P = 0.002$) (Figure 4).

Reflux into the reimplanted ureter was as-

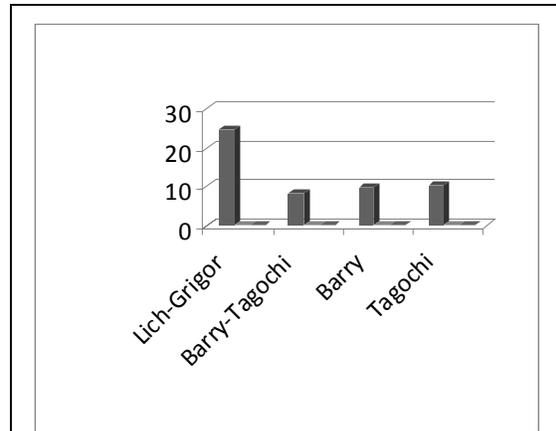


Figure 6. Comparing of mean time taken for ureteroneocystostomy with the four techniques in the study population.

sessed randomly in the three groups. Reflux was seen in eight cases (16%) in the Barry-Tagochi group, 23 (38%) cases in the Barry group, and in 50 cases (27%) in the Lich-Grigor group; no significant difference was found between these groups ($P = 0.021$) (Figure 5).

We compared the mean time taken for performing ureteroneocystostomy in the four groups. The mean time was about 8.2 minutes in the Barry-Tagochi group, about 9.97 min in the Barry group, about 10.2 min in the Tagochi group, and finally, it was 24.6 min in the Lich-Grigor group. We found that the mean time was significantly longer in the Lich-Grigor group when compared with the other groups ($P = 0.001$) (Figure 6).

Discussion

With the advances made in the field of kidney transplantation, urological complications remain a major concern. In early reports of renal transplantation, the prevalence of urologic complications varied from 10 to 25%, with a mortality rate ranging from 20 to 30%.^{7,8} In these patients, uretero-ureterostomy or pyelo-ureterostomy was used to restore urinary tract continuity. However, the reconstructive technique used in most active kidney transplantation programs today is ureteroneocystostomy, which carries a lower incidence of

urine leak or obstruction compared with patients who underwent the older procedures.^{7,8} Approximately two-thirds of the early urologic complications (urine leak, fistula formation, or obstruction) are apparent in the first month after transplantation and are treated by the transplantation team. Currently, urologic complication rates are seen in 4-8% of transplants and carry a very low patient mortality.^{7,8}

Extra-vesical ureteroneocystostomy has slowly gained popularity since its description by Lich et al in 1961 as a method for ureteral reimplantation in kidney transplant recipients. Complication rates of 3.7 to 7.5% for other methods of extra-vesical ureteroneocystostomy have been reported by several centers.⁹⁻¹² Thrasher et al reported comparison of trans-vesical and extra-vesical reimplantation and found complication rates of 9.4% and 3.7%, respectively.¹² Gibbons, in the year 1992, reported 1000 transplant patients who underwent reimplantation by the Barry technique and found complications in 2.1% of the cases; the complications included bleeding, extravasation, and reflux.¹³ Advantages of extra-vesical ureteroneocystostomy include: less operative time, avoidance of a separate cystotomy, virtually no hematuria, ability to use short ureters, no need for splints or stents, shortened Foley's catheter drainage, and no interference with native ureteral function.²

Urine leaks and urinomas are relatively rare complications of transplantation and usually constitute an early postoperative problem. Extravasation of urine may occur from the renal pelvis, ureter, or ureteroneocystostomy site due to ureteral necrosis caused by vascular insufficiency or increased urinary pressure caused by obstruction. Early detection and repair have been instrumental in reducing patient mortality.¹⁴

Calyceal leakage caused by infarction is treated with percutaneous nephrostomy alone. Ureteral stents must be kept in place for six to eight weeks after cessation of leakage to allow complete healing of the ureter and to preserve long-term patency. If healing is unsuccessful, reimplantation of the ureter may be required; if distal necrosis is present, pyelo-cystostomy or

pyelo-ureterostomy with the native ureter is performed.¹⁴

Urinary obstruction occurs in approximately 2% of transplantations and almost always within the first six months after the procedure. Obstruction of the transplanted kidney may occur at any location, but it is most frequent at the site of implantation of the ureter into the bladder. Occasionally, obstruction that develops years after transplantation, especially in patients who have undergone multiple procedures, may be related to adhesions, vascular insufficiency, or fibrosis.^{15,16} Complicated hematuria post-transplantation, requiring endoscopic or surgical treatment, is rare following extra-vesical ureteral reimplantation.^{14,15}

In 1993, Caparrós J for the first time used a combined technique of Barry and Tagochi; complications were seen in about 12.8% of the patients in this study and consisted of ureteral stenosis in 3.9%, fistula in 3.9%, and complicated hematuria in 4.9%.¹⁷ We used this technique for the first time in our institute in Iran and compared the rate of complications with the Barry technique. We found that the Barry and Tagochi technique is a safe method with low rate of complications and relatively easy for ureteral reimplantation; we have been using this technique for the last four years.

Secin FP in 2002, compared the Tagochi and Lich-Grigor ureterovesical reimplantation techniques and found that the Lich-Grigor technique carried a greater risk for occurrence of urological complications. The Tagochi method has become the ureterovesical reimplantation technique of choice in our setting.¹⁸ However, Lee RS stated in 2007 that the Tagochi ureteroneocystostomy resulted in dramatically higher complication rates than the modified Lich-Grigor technique.¹⁹

In our study, we found that the highest complication rate occurred in the Lich-Grigor group (5.6%). Also, the highest rate of urinary leak occurred in the Lich-Grigor group. The highest rate of ureteral stenosis and obstruction was seen in the Barry-Tagochi group (2.8%). All above differences were not statistically significant. The only significant difference was in complicated hematuria; the Tagochi tech-

nique had the highest rate of complicated hematuria after surgery (6.8%) in our series and interestingly, we had no case of complicated hematuria in the Barry group. The highest rate of reflux was seen in the Barry group, seen in 40.4% of cases.

Finally, we compared the mean time taken for ureteroneocystostomy in the four groups; the least time was seen in the Barry-Tagochi technique and the maximum time was related to the Lich-Grigor technique; this difference was statically significant.

The Barry-Tagochi ureteroneocystostomy group had an overall incidence of urological complications similar to that of the other techniques and was less time consuming. In our study, the Barry-Tagochi ureteroneocystostomy technique (new technique) proved to be a more rapid and simple method without increasing the incidence of urological complications. It is obvious that a simpler surgical technique is preferable to a complex one, if similar results can be obtained. Thus, the Barry-Tagochi technique has become one of the choice techniques in our center.

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