

## IS IT SAFE TO REMOVE THE PERITONEAL CATHETER DURING KIDNEY TRANSPLANTATION SURGERY?

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**Abstract:** Transplantologists have not reached agreement on whether the optimal time for peritoneal catheter for peritoneal dialysis removal is during or at a later point after kidney transplant surgery. One of the main reasons for not removing the peritoneal catheter during kidney transplant surgery is delayed allograft function and the need for dialysis. On the other hand, an increased risk for peritoneal catheter-related infections is the main argument for earlier (simultaneously with kidney transplantation surgery) peritoneal catheter extraction. The aim of our study was to investigate outcomes of peritoneal catheter removal during kidney transplant surgery in our transplant center. During a 10-year period (2013 – 2022) 509 kidney transplantations were performed in our center. The retrospective study included all 78 (15 %) adult kidney transplant recipients who were on peritoneal dialysis at the time of the transplantation. In 75 of them, the peritoneal catheter was removed during the kidney transplant surgery and they were included in further analysis. Delayed graft function developed in 18 patients, requiring hemodialysis. Peritonitis or surgical complications related to peritoneal catheter removal did not occur during the post-transplantation period in any of the 75 patients. One-year patient survival was 99 %, and graft survival was 99 % as well. Kidney graft function at 1 year was good (median serum creatinine 114 µmol/L, ranging from 49 to 427). Our ten-year experience with 75 patients in whom peritoneal catheter removal was performed during the kidney transplant surgery provided clear evidence that such a timing approach should be considered safe and without complications, thus rendering avoidance of one more anesthesia, while possibly reducing the risk of peritonitis as well as the costs involved.

**Keywords:** peritoneal catheter extraction, time, peritonitis, kidney transplantation

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### INTRODUCTION

Kidney transplantation (TX) is considered the optimal renal replacement therapy and many patients with end-stage kidney disease undergoing peritoneal dialysis (PD) will eventually receive a kidney allograft (1). There is as yet no definite agreement among transplantologists whether the optimal time for peritoneal catheter (PC) for PD removal is during or some time after kidney TX surgery (2-7). One of the main reasons against PC removal during kidney TX surgery is providing a dialysis access ready in case of delayed allograft function (DGF) or allograft failure (8). On the other hand, an increased risk for

PC-related infections due to immunosuppression is the main argument for earlier (simultaneously with kidney TX surgery) PC extraction (3). In one study, the need for dialysis support (PD or hemodialysis, HD) after TX was associated with an increased risk for peritonitis (9). According to one study among the pediatric population, PC should not be removed until one month after kidney TX (6). In another study, PC removal was undertaken between eight and 12 weeks after kidney TX (7). In certain circumstances, such as infectious or mechanical complications, PC should be removed before or during kidney TX (4, 6, 7). In simultaneous pancreas and kidney transplantation (SPKT) there is no option to leave PC for PD *in situ*, and this is an

additional circumstance where immediate removal of PC for PD should be considered. Additionally, in living donor kidney TX, which is associated with a lower risk of DGF, prompt PC removal should be considered (8). According to the 2005 European Best Practice Guidelines for peritoneal dialysis, PC can be left *in situ* for three to four months even with a functioning graft, but earlier PC removal after a successful kidney TX is also appropriate (10). More recently, Zawistowski et al. conducted a systematic review and meta-analysis of observational studies comparing patients with PC for PD left in place or removed during kidney TX (2). The meta-analysis included five studies with a total of 338 patients. The results showed that patients with PC left *in situ* were at a higher risk of needing dialysis, and experienced more catheter-related infections compared to patients in whom PC was removed during kidney TX (2). Nevertheless, the authors concluded that owing to scarce evidence and the absence of randomized trials, the question of the ideal time for PC removal cannot be answered as yet (2). The aim of our study was to investigate outcomes of PC removal during kidney TX surgery in our transplant center.

## MATERIALS AND METHODS

During a 10-year period (2013 – 2022) 509 kidney TXs were performed in our center. The retrospective study included all 78 (15 %) adult kidney TX recipients who were on PD at the time of TX. In 75 of them, PC for PD was removed during kidney TX surgery. In three patients, PC for PD was left *in situ* at the time of kidney TX surgery at the surgeon's discretion, and was removed some time after TX. For those three patients in whom PC for PD was left *in situ*, data were available only for one patient. That patient had DGF and PD was used for dialysis but the efficiency was suboptimal, and therefore a central venous catheter (CVC) for dialysis was placed. There were no infectious complications related to the PC for PD *in situ* and it was removed 10 months after TX. One year after TX, allograft function was good (estimated glomerular filtration rate 39 mL/min/1.73m<sup>2</sup> body surface area). The 75 patients whose PC was removed simultaneously with kidney TX were included in the further analysis. Hospital and outpatient data records including gender, age, duration of chronic dialysis, peritonitis after kidney TX, surgical complications related to PC removal, patient survival at one year after TX, allograft survival at one year after TX, and allograft function at one year after TX were

analyzed. DGF was defined by the need for dialysis in the first week post-transplant, and slow graft function (SGF) was defined by serum creatinine > 265 µmol/L on post-transplantation day five but without need for dialysis<sup>11</sup>. The study was conducted according to the Declaration of Helsinki.

## STATISTICS

Continuous variables are expressed as medians (min. – max.) and categorical variables as absolute numbers (percentages). Differences between the groups were analyzed using the Mann-Whitney test for continuous variables and the Chi-square test, or Fisher exact test, when appropriate, for categorical variables. Statistical analysis was performed using the Social Science Statistics software at <https://www.socscistatistics.com/tests/>, and  $P < 0.05$  was considered significant.

## RESULTS

There were 75 analyzed patients, of whom 39 (52 %) were men. Median age was 49 years at the time of TX, ranging from 20 to 77 years. Sixty-one patients had kidney TX, and 14 patients underwent SPKT. Living kidney TX was performed in four patients. Median duration of chronic dialysis was 2 years, ranging from 0 to 8 years. DGF requiring HD was recorded in 18 patients. SGF was observed in six patients who did not require dialysis. The remaining patients had immediate graft function (68 %). Among the patients who developed DGF requiring dialysis, there were no infectious complications regarding CVC. In 12 of them CVC was placed in the jugular vein (in 11 on the right side). In one patient CVC was placed in the left jugular vein, but due to malposition it was extracted and another catheter was placed in the right jugular vein. The subclavian vein was used for CVC placement in 5 patients (4 on the right side), and in one patient CVC was placed into the femoral vein. Kidney biopsy was performed in six patients. Acute cellular rejection IA was diagnosed in three patients, and was treated with boluses of steroids. Of those patients with DGF, only one patient did not recover kidney function. Peritonitis did not occur during the post-transplantation period in any of the 75 patients that underwent PC removal during kidney TX surgery, and no surgical complications were recorded either. One-year patient survival was 99 % (one patient died in a traffic accident) and overall graft survival was 97 % (one patient expe-

rienced primary graft failure). Kidney graft function at 1 year expressed as median serum creatinine was 114  $\mu\text{mol/L}$ , ranging from 49 to 427 (Table 1).

## DISCUSSION

The optimal time for PC removal in kidney TX recipients is a matter of debate (2, 8). A potential need for dialysis support due to DGF or allograft failure on the one hand, and the risk of PC-associated peritonitis on the other, are of concern (3, 8). We retrospectively investigated the safety of early PC for PD removal performed simultaneously with kidney TX surgery. Our research showed that none of the patients had infectious or surgical complications related to PC removal during kidney

TX surgery. Furthermore, allograft function at one year after kidney TX was good, and allograft and patient survival were excellent. Among the patients who developed DGF and required dialysis, CVC was placed without any infectious complications. Only in one patient CVC malposition occurred, requiring replacement. Our cohort consisted of almost all PD patients that received kidney transplants during the period 2013 – 2022. Rizzi et al. showed that patients in whom PC for PD was used within six weeks after TX had a more than three times higher risk for developing peritonitis compared to those who did not use PC after kidney TX. In the same study, 9 % of patients developed peritonitis after TX (9). In the cohort of 112 patients with PC left *in situ* until optimal allograft function was established,

Table 1. Patient, donor, and transplant characteristics

Patient characteristics (N = 75)	
Age (years)	median 49 (min. 20 – max. 77)
Males : females (n)	39 (52 %) : 36 (48 %)
Duration of chronic dialysis (years)	median 2 (min. 0 – max. 8)
DGF : SGF : IGF (n)	18 (24 %) : 6 (8 %) : 51 (68 %)
DGF	n = 18
TX from a living donation	n = 0
TX from a brain-dead person (marginal donors)	n = 18 (n = 3, 16.7 %)
Peritonitis after TX (n)	0
Surgical complication related to PC removal (n)	0
Patient survival at 1 year	99 %
Overall graft survival at 1 year	97 %
Creatinine at 1 year ( $\mu\text{mol/L}$ )	median 114 (min. 49 – max. 427)
Donor characteristics (N = 75)	
Age (years)	median 48 (min. 30 – max. 56)
Males : females (n)	47 (62.7 %) : 28 (37.3 %)
Transplant characteristics (N = 75)	
Kidney TX : SPKT (n)	61 (81.3 %) : 14 (18.7 %)
Living kidney TX (n)	4 (5.3 %)
Number of HLA MM (A-, B-, DR locus) (n = 71)*, (n)	
0	
1 - 2	2 (2.8 %)
3 - 4	8 (11.3 %)
5 - 6	47 (66.2 %)
	14 (19.7 %)

\*only for deceased donors; TX = transplantation, SPKT = simultaneous pancreas and kidney transplantation, DGF = delayed graft function, SGF = slow graft function, IGF = immediate graft function; PC = peritoneal catheter, HLA – human leukocyte antigen, MM - mismatch

8 % developed PC-related infection during an eight-month follow-up (4). Another study advocates leaving PC *in situ* up to 45 days after TX. In that study, which included 65 PD patients who had kidney TX, one patient developed peritonitis while waiting for PC removal (5). Another study tried to elucidate in which patients safe PC removal during kidney TX can be performed (8). It was found that, taking into account a small risk of DGF, living donor kidney recipients are great candidates for early PC removal (8). It was also shown that catheter-related complication rates were similar in PD and HD patients (4.5 % PD vs 2.6 % HD;  $P = 0.3$ ) (8). Warren et al. showed that 7 % of patients with PC left *in situ* and not used after kidney TX developed infectious complications, while complications in those in whom PC for PD had been used occurred in more than 50 % of cases (33 % developed peritonitis, and 20 % dialysate-derived fluid leaks) (3). Considering the high rate of complications associated with PC remaining *in situ* after TX, the authors concluded that PC removal should be considered during kidney TX surgery (3). Other reasons for early PC removal include avoiding patient exposure to additional invasive procedures, anesthesia, and hospitalization. There have been no prospective studies on that subject so far. A recently conducted systematic review and meta-analysis analyzed the best time for PC for PD removal in transplant patients. The study included eight observational studies, and five of them comprising 338 patients were taken into meta-analysis. The results showed that the incidence of PC-related infections (peritonitis and exit-site infections) was 10.2 % in patients with PC left *in situ*, while it was rare in patients with PC removed (2). According to the literature data, there are various protocols regarding management of PC for PD in patients undergoing kidney TX (2-8). Our ten-year experience with 75 patients in whom PC for PD removal was performed during the kidney TX surgery provided clear evidence that such a timing approach should be considered safe and without complications, thus rendering avoidance of one more anesthesia and possibly reducing the risk of peritonitis. A randomized study would provide the best insight into PD outcomes in kidney transplant patients depending on whether the PC for PD has been removed during kidney TX or at a later point. The limitations of our study include single-center analysis, the retrospective nature of the study, a small cohort, and absence of a control group.

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## SAŽETAK

### JE LI SIGURNO ODSTRANITI PERITONEJSKI KATETER TIJEKOM BUBREŽNE PRESADBE?

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Optimalno vrijeme za odstranjenje peritonejskog katetera za peritonejsku dijalizu predmet je debate među transplantacijskim nefrolozima. Odgođena funkcija presatka i potreba za dijalizom glavni su argumenti za kasnije odstranjenje peritonejskog katetera (tj. nakon bubrežne presadbe), dok je povećan rizik od infekcije glavni argument za ranije odstranjenje peritonejskog katetera (tj. tijekom bubrežne presadbe). Cilj našega istraživanja bio je analizirati ishode prilikom odstranjenja peritonejskog katetera tijekom bubrežne presadbe u našem transplantacijskom središtu. Tijekom 10-godišnjeg razdoblja bilo je 509 presadbi bubrega u našem središtu. U retrospektivno istraživanje uključeno je svih 78 (15 %) primatelja bubrega koji su bili na peritonejskoj dijalizi. U 75 bolesnika peritonejski kateter odstranjen je tijekom operativnog zahvata bubrežne presadbe i oni su uključeni u daljnju analizu. Odgođenu funkciju presatka razvilo je 18 bolesnika i oni su zahtijevali hemodijalizu. Peritonitis, kao ni kirurške komplikacije vezane uz odstranjenje peritonejskog katetera, nisu zabilježeni ni u jednog bolesnika u poslije-transplantacijskom praćenju. Jednogodišnje preživljenje bolesnika iznosilo je 99 %, a jednogodišnje preživljenje presatka također 99 %. Funkcija presatka godinu dana nakon presadbe bila je dobra (medijan serumskog kreatinina 114  $\mu\text{mol/l}$ , od 49 do 427). Naše 10-godišnje iskustvo sa 75 bolesnika kojima je peritonejski kateter odstranjen tijekom bubrežne presadbe dalo je jasan dokaz da je ovakav pristup siguran, bez komplikacija, a omogućuje izbjegavanje dodatne anestezije, moguće i smanjenje rizika za peritonitis, kao i smanjenje troškova liječenja.

**Ključne riječi :** odstranjenje peritonejskog katetera, vrijeme, peritonitis, bubrežna presadba

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