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ORIGINAL ARTICLE

Impact of failed allograft nephrectomy on initial function and graft survival after kidney retransplantation

Christina Schleicher,[1] Heiner Wolters,[1] Linus Kebschull,[1] Christoph Anthoni,[1] Barbara Suwelack,[2] Norbert Senninger[1] and Daniel Palmes[1]

1 Department of General and Visceral Surgery, University of Muenster, Germany
2 Department of Nephrology, University of Muenster, Germany

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Correspondence
Christina Schleicher MD, Department of General and Visceral Surgery, University of Muenster, Waldeyerstrasse 1, D-48151 Muenster, Germany. Tel.: +49 251 83 56301; fax: + 49 251 83 56480; e-mail: christina.schleicher@ukmuenster.de

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Summary

The management of an asymptomatic failed renal graft remains controversial. The aim of our study was to explore the effect of failed allograft nephrectomy on kidney retransplantation by comparing the outcome of recipients who underwent graft nephrectomy prior to retransplantation with those who did not. Retrospective comparison of patients undergoing kidney retransplantation with (group A, $n = 121$) and without (group B, $n = 45$) preliminary nephrectomy was performed, including subgroup analysis with reference to patients with multiple (≥2) retransplantations and patients of the European Senior Program (ESP). Nephrectomy leads to increased panel reactive antibody (PRA) levels prior to retransplantation and is associated with significantly increased rates of primary nonfunction (PNF; $P = 0.05$) and acute rejection ($P = 0.04$). Overall graft survival after retransplantation was significantly worse in group A compared with group B ($P = 0.03$). Among the subgroups especially ESP patients showed a shorter graft survival after previous allograft nephrectomy. On the multivariate analysis, pretransplant graft nephrectomy and PRA >70% were independent and significant risk factors associated with graft loss after kidney retransplantation. Nephrectomy of the failed allograft was not beneficial for retransplant outcome in our series. Patients with failed graft nephrectomy tended to have a higher risk of PNF and acute rejection after retransplantation. The possibility that the graft nephrectomy has a negative impact on graft function and survival after retransplantation is worth studying further.

Introduction

Over the last decades important advances have been made in every aspect of kidney transplantation, resulting in significant improvement of renal allograft survival. Nevertheless, the rate of graft failure remains about 10% in the first year, and 3% to 5% each year afterward [1]. As recipients of kidney transplants are growing in absolute numbers, so are the patients with failed allografts and the potential candidates for retransplantation. Repeat transplantation is associated with improved overall survival of patients with failed renal allografts [2]. The outcome of kidney retransplantation has been significantly improved in recent times but still lags behind that of primary transplantation [3,4]. The influence of primary allograft nephrectomy on retransplantation outcome has recently been investigated in several studies [5–7] but it is still unclear whether removal of the failed allograft affects long-term outcome after renal retransplantation and the management of the failed allograft that is not immediately symptomatic remains controversial.

A failed transplant *in situ* may induce a chronic inflammatory response syndrome characterized by elevated C-reactive protein, increased resistance to erythropoietin, hypoalbuminemia and malnutrition [8,9] thereby leading to increased morbidity of patients on hemodialysis and

compromising their fitness for potential retransplantation. A current study suggested that transplant nephrectomy is associated with improved survival in patients who remain on dialysis after allograft failure and are not subjected to retransplantation [10]. An advantage of not removing the allograft would be the avoidance of the considerable high risk of surgical morbidity and mortality in an immunosuppressed patient who may be uremic and has co-morbid diseases such as arteriosclerosis and diabetes that might additionally increase the risk for severe vascular complications [11]. Another consideration is the immunologic effect of graft nephrectomy. It has been observed that the panel reactive antibody (PRA) level of patients following allograft nephrectomy is raised [7] what may be detrimental for the new transplant.

The aim of our study was to explore the effect of failed allograft nephrectomy on a subsequent transplant by comparing the outcome of recipients who underwent graft nephrectomy prior to retransplantation with those who had a previous graft retained.

Patients and methods

Between April 1st, 2000 and August 31st, 2008, we performed 799 kidney transplantations in our institution including 166 (21%) retransplantations. Patients included in group A ($n = 121$) underwent allograft nephrectomy prior to retransplantation, in patients of group B ($n = 45$) nephrectomy was not performed. Subgroup analysis of patients with multiple retransplantations (≥2), patients who received donor kidneys in line with the Eurotransplant Senior Program (ESP) patients who were classified under neither of these two groups of high risk recipients (''low risk'', Fig. 1). Primary endpoints were graft survival, patient survival and rate of acute rejections. The effect of patient and donor characteristics, HLA matching and levels of PRA on transplant outcome were also examined.

Data collection was performed retrospectively. Data from prior, during and after surgery were retrieved from the patient's medical files and from the local transplant registry. Long-term follow up information was obtained from the patient's general nephrologist. Donor data were retrieved from ET donation forms and organ reports.

Pretransplant flow cytometric and complement dependent cytotoxicity (CDC)-crossmatching was performed in all recipients. Transplantation was not performed in case of any positive crossmatch result. Donor specific antibodies (DSA) were not measured routinely. The common immunosuppressive regimen consisted of a calcineurin-inhibitor (CNI; cyclosporine or tacrolimus), steroids and mycophenolate mofetil (MMF) completed by induction therapy using an interleukin (IL-)2-receptor-antagonist (Basiliximab, Simulect®; Novartis International AG, Basel, Switzerland) 20 mg intraoperatively and on postoperative day 4. Patients with PRA levels higher than 30% received perioperative plasmapheresis which was started preoperatively and continued daily until the 4th postoperative day in combination with induction therapy with antithymocyte globulin (ATG, 1.5 mg/kg). Methylprednisolone was administered during surgery (500 mg) with progressive tapering to 20 mg/day within the 8th postoperative day. Cyclosporine was started 6–12 h after transplantation and adjusted to obtain trough blood levels of 350–450 ng/ml. Tacrolimus was started 6–12 h after surgery and increased to achieve tacrolimus trough levels of 8–11 ng/ml. MMF was administered 2000 mg/day.

Early surveillance of kidney function was obtained by daily monitoring of diuresis, creatinine serum levels and color-coded doppler ultrasound. Renal graft did not undergo scheduled surveillance biopsies unless rejection was assumed. Renal allograft rejection in this study was defined by any episode resulting in an increase in immunosuppressive therapy. Delayed graft function (DGF) was defined as postoperative need for dialysis at least one session until the 7th postoperative day. Primary nonfunction

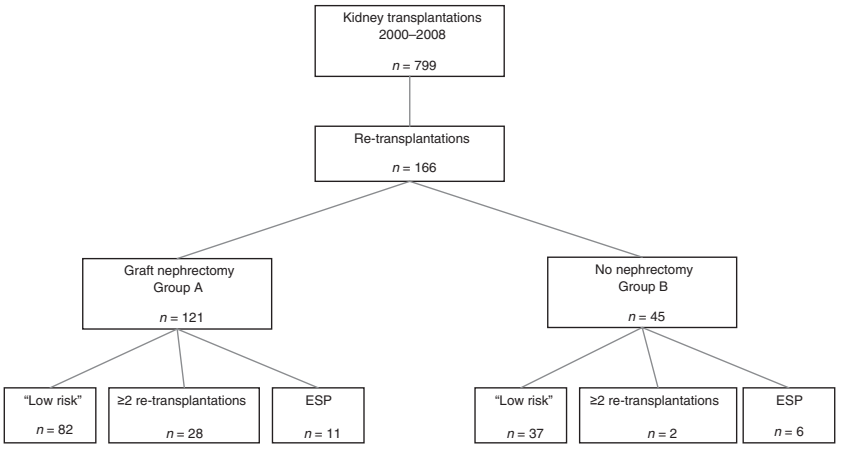

Figure 1 Distribution of the patient population in various subgroups.

(PNF) was defined as need for dialysis for equal or more than 4 weeks after transplantation.

The follow up was complete for all patients at an average follow up time of 64 ± 30 months (range: 16–115 months) by December 31st, 2009. Graft and patient survival of the two groups were calculated by the Kaplan–Meier method and compared using the log rank test. The two groups were compared using Student's *t*-test and Kruskal–Wallis test. Variables are presented as mean ± standard deviation or median (minimum – maximum range). A value of $P < 0.05$ was considered statistically significant. Multivariate analysis was performed using the logistic regression model to identify independent factors that were associated with postoperative kidney graft loss. Statistical analyses were performed using SPSS 17.0 for Windows computer software (SPSS Inc., Chicago, IL, USA).

Results

Of 166 patients with kidney retransplantation, 121 (73%) had allograft nephrectomy (group A), while 45 (27%) had their failed grafts retained (group B). Indications for allograft nephrectomy were pain, anemia, recurrent urinary tract infections, and as preliminary measure for kidney retransplantation. A total of 136 (82%) patients received their second kidney allograft, whereas 30 (18%) patients underwent at least their third kidney transplantation. Among the patients of group A, 28 (23%) patients received multiple retransplantations (second $n = 22$, third $n = 5$, fourth $n = 1$), whereas in group B only two (4%) patients underwent their 3rd and 4th kidney transplantation respectively. Eleven (9%) patients of group A received kidneys from an ESP donor, six (13%) patients from group B received ESP donor allografts (Fig. 1).

The recipient and donor characteristics of both groups and subgroups are listed in Tables 1 and 2. Of note, the average interval between the previous transplantation and kidney graft loss was shorter in group A compared with group B (70 ± 54 vs. 99 ± 56 months, $P = 0.05$). Hemodialysis time before recent transplantation was longer in patients with previous nephrectomy (group A: 60 ± 34 vs. group B: 35 ± 30 months, $P = 0.05$, Table 1). Moreover, the number of patients with either primary graft PNF of the previous graft or graft function of <6 months was also

Table 1. Baseline characteristics of recipients.

	Group A ($n = 121$) Nephrectomy	Group B ($n = 45$) No nephrectomy	*P*
Age (years)			
Overall	44 ± 13 (11–71)	53 ± 16 (22–70)	NS
''low risk''	43 ± 12 (11–62)	45 ± 15 (14–63)	NS
≥2 retransplantations	40 ± 10 (26–59)	34 ± 17 (22–34)	NS
ESP	66 ± 5 (65–71)	68 ± 2 (65–70)	NS
Gender (male:female)			
Overall	76:45	31:14	
''low risk''	51:31	26:11	
≥2 retransplantations	15:13	0:2	
ESP	10:1	5:1	
Interval between primary kidney transplantation and graft loss (months)			
Overall	70 ± 54 (1–294)	99 ± 56 (1–226)	0.05
''low risk''	67 ± 50 (1–195)	102 ± 59 (1–226)	0.01
≥2 retransplantations	66 ± 46 (1–168)	95 ± 35 (70–120)	0.05
ESP	108 ± 91 (15–294)	84 ± 41 (15–137)	0.05
Time of hemodialysis before recent transplantation (months)			
Overall	60 ± 34 (1–124)	35 ± 30 (2–94)	0.05
''low risk''	64 ± 34 (1–122)	38 ± 32 (2–94)	0.03
≥2 retransplantations	53 ± 33 (1–124)	51 ± 11 (43–58)	NS
ESP	108 ± 91 (15–294)	13 ± 16 (2–42)	0.01
Initial immunosuppressive therapy (%)			
Cyclosporine/MMF/Pred	41 (33)	16 (36)	NS
Tacrolimus/MMF/Pred	80 (67)	29 (64)	NS
Induction with Basiliximab	102 (84)	44 (98)	NS
Induction with ATG and plasmapheresis	19 (16)	1 (2)	NS

ATG, anti-thymocyte globulin; ESP, European Senior Program; MMF, mycophenolate mofetil; NS, nonsignificant; Pred, prednisolon.

Table 2. Baseline donor characteristics and operative data.

	Group A (n = 121) Nephrectomy	Group B (n = 45) No nephrectomy	P
Donor age (years)			
Overall	47 ± 14 (1–80)	51 ± 14 (9–82)	NS
''low risk''	45 ± 13 (9–64)	47 ± 12 (9–64)	NS
≥2 retransplantations	44 ± 14 (18–68)	50 ± 4 (47–63)	NS
ESP	68 ± 7 (65–80)	71 ± 6 (66–82)	NS
Donor type (%)			
ESP	11 (9)	6 (13)	NS
LRD	8 (7)	14 (31)	0.01
Gender mismatch (%)			
Overall	63 (52)	26 (58)	NS
''low risk''	46 (56)	22 (59)	NS
≥2 retransplantations	13 (46)	0 (0)	NS
ESP	4 (36)	4 (67)	NS
HLA mismatch			
Overall	2.2 ± 1.5	2 ± 1.7	NS
''low risk''	2.0 ± 1.4	1.7 ± 1.6	NS
≥2 retransplantations	1.9 ± 1.5	0.6 ± 0.7	NS
ESP	4.3 ± 0.9	3.8 ± 1.2	NS
Cold ischemic time (hours)			
Overall	12 ± 5	10 ± 7	NS
''low risk''	12 ± 5	10 ± 7	NS
≥2 retransplantations	15 ± 6	10 ± 8	NS
ESP	12 ± 4	11 ± 6	NS
Warm ischemic time (min)			
Overall	30 ± 6	28 ± 7	NS
''low risk''	30 ± 6	27 ± 8	NS
≥2 retransplantations	32 ± 5	28 ± 3	NS
ESP	29 ± 8	34 ± 4	NS

ESP, European Senior Program; LRD, living related donor; NS, nonsignificant.

Table 3. Results.

	Group A (n = 121) Nephrectomy	Group B (n = 45) No nephrectomy	P
PRA positive (%)			
Overall	45/121 (37.2)	8/45 (17.8)	0.02
>30%	19/121 (16)	1/45 (2)	
>70%	6/121 (5)	0	
''low risk''	33/82 (40.2)	7/37 (18.9)	0.02
≥2 retransplantations	11/28 (39.3)	1/2 (50)	NS
ESP	1/11 (9.1)	0/6 (0)	NS
Median current PRA level (%)			
Overall	20 (2–100)	19 (2–57)	NS
''low risk''	17 (2–100)	18 (2–57)	NS
≥2 retransplantations	29 (5–91)	20 (0–20)	NS
ESP	41 (0–41)	0	NS
DGF (%)			
Overall	33/121 (29.8)	9/45 (20)	NS
''low risk''	24/82 (29.2)	7/37 (18.9)	NS
≥2 retransplantations	2/28 (7.1)	0/2 (0)	NS
ESP	7/11 (63.6)	2/6 (33.3)	NS
PNF (%)			
Overall	18/121 (14.8)	2/45 (4.4)	0.05
''low risk''	5/82 (6.2)	2/37 (5.4)	NS
≥2 retransplantations	11/28 (39.3)	0	0.05
ESP	2/11 (22.2)	0	NS
DGF + PNF (%)			
Overall	54/121 (44.6)	11/44 (25)	0.02
''low risk''	30/81 (37)	9/36 (25)	NS
≥2 retransplantations	12/28 (42.8)	0 (0)	NS
ESP	9/11 (75)	2/6 (33.3)	NS
Patients with at least 1 acute rejection (%)			
Overall	36/121 (29.7)	6/45 (13.3)	0.04
''low risk''	26/82 (31.7)	4/37 (10.8)	0.01
≥2 retransplantations	4/28 (14.2)	1/2 (50)	NS
ESP	6/11 (54.5)	1/6 (16.7)	NS

DGF, delayed graft function; ESP, European Senior Program; PNF, primary nonfunction; PRA, panel reactive antibody; NS, nonsignificant.

higher in group A (12% vs. 4% and 10% vs. 4%, respectively). Almost one-third of the group B patients received allografts from a living related donor for retransplantation, which was significantly more compared with group A (31% vs. 7%, P = 0.001).

Patients who underwent previous nephrectomy (group A) showed significantly more positive PRA levels (group A: 37.2% vs. group B: 17.8%, P = 0.02) (Table 3), as measured before the most recent transplant. More patients in group A showed high PRA levels ≥30% and ≥70% compared with group B (16% vs. 2% and 5% vs. 0%). In group A, DGF was observed in 33 of 121 (29.8%) patients whereas nine of 45 (20%) patients of group B developed DGF. PNF was noticed in 18 of 121 (14.8%) patients of group A compared with two of 45 (4.4%) patients of group B (P = 0.05). Summarizing patients with DGF and PNF, the incidence of poor initial graft function was significantly higher in group A (P = 0.02). Renal allograft rejection was noted in 36 (29.7%) patients of group A and six (13.6%) patients of group B (P = 0.04). Ninety-five percent (n = 40) of the rejections in group A and 100% in group B were steroid responsive. Both patients with steroid resistant rejection in group A received treatment with ATG. There was no difference in immunosuppression among patients who developed acute rejections, 30% and 33% received cyclosporine instead of tacrolimus in group A and B respectively.

After an average follow up of 67 ± 29 months 36 of 121 (30%) patients of group A lost their allograft after retransplantation. In group B, renal allograft loss was observed in seven of 45 (15%) patients of group B after an average follow up of 55 ± 30 months. Median time between retransplantation and renal graft failure was 7.5 months in group A and 15 months in group B. The overall graft survival was significantly better in group B (P = 0.03, Fig. 2a), whereas patient survival was comparable between both groups (Fig. 3a).

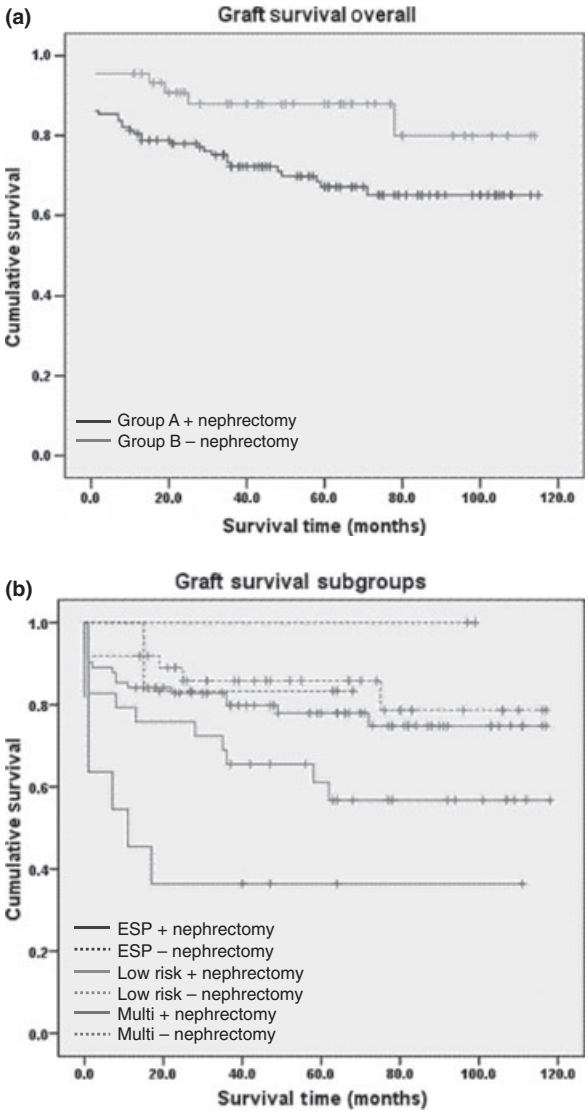

Figure 2 Graft survival (a) Overall, (b) Subgroups.

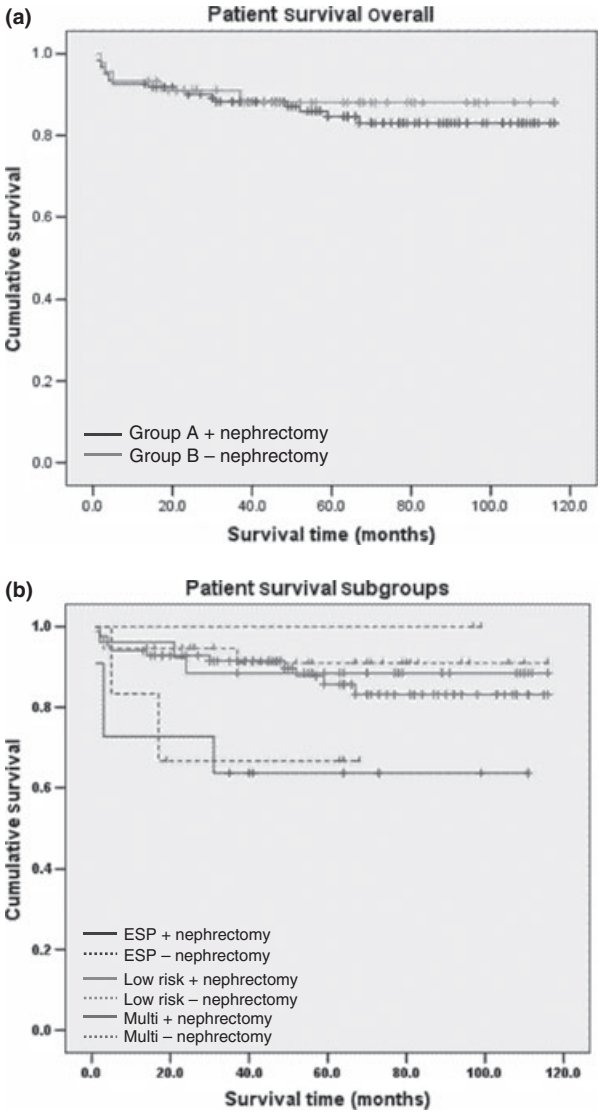

Figure 3 Patient survival (a) Overall, (b) Subgroups.

Among the patients who received grafts from ESP donors, 11 patients underwent nephrectomy of the failed graft, in six patients previous grafts were retained. One patient (9.1%) of group A demonstrated to have elevated PRA measured before retransplantation. Acute rejection episodes were observed in 54.4% of nephrectomy patients and in 16.7% of patients without nephrectomy. However, seven (63.6%) patients who received ESP donor kidneys after having their failed allograft removed developed post-operative DGF, in another two (22.2%) patients of this subgroup PNF was diagnosed. Two patients (33.3%) developed DGF after retransplantation without previous transplant nephrectomy. Among this subgroup, graft survival was better if the failed allograft was preserved ($P = 0.05$, Fig. 2b).

Transplant nephrectomy was performed in 28 patients who received at least their second retransplantation, two patients had their last nonfunctioning graft left *in situ* before retransplantation. Half of each group was positive for PRA. Acute rejections occurred in 43% ($n = 12$) of patients with previously performed nephrectomy and 50% ($n = 1$) of patients without nephrectomy. DGF was observed in 14 of 28 (50%) patients with multiple retransplantations and previous allograft nephrectomy and in none of the two patients who had their failed graft left in before their second retransplantation; 43% ($n = 12$) of the patients with previous transplant nephrectomy lost their subsequent graft in this subgroup. Patient and graft survival are shown in Fig. 2 and 3 and in Table 4.

Table 4. Graft and patient survival.

	TXE (months)	No TXE (months)	*P*
Graft survival			
Overall	81.9 ± 4.5	98.9 ± 5.7	0.03
ESP	43.5 ± 15.4	59.2 ± 8.1	0.05
Low risk	92.5 ± 6.1	98.8 ± 6.7	0.47
Patient survival			
Overall	100.6 ± 3.4	106.9 ± 4.9	0.63
ESP	74.1 ± 14.9	49 ± 11.1	0.87
Low risk	102.1 ± 3.9	103.8 ± 5.1	0.51

ESP, European Senior Program; TXE, graft nephrectomy.

Table 5. Multivariate analysis on independent risk factors for kidney graft loss after retransplantation.

Independent factor	*P*	Relative risk	95% CI
Pretransplant nephrectomy	0.05	2.244	0.9–5.084
PRA >70%	0.018	3.504	1.2–8.9
Acute rejection	0.151	∅	∅
PRA >30%	0.525	∅	∅

PRA, panel reactive antibody.
∅No multivariate analysis performed.

The ''low risk''-subgroup patients accounted for 82 (68%) of group A and 37 (82%) of group B; 40% of these group A recipients and 19% of these group B patients had positive PRA measured preoperatively ($P = 0.02$). Acute rejections appeared more frequently after nephrectomy in this subgroup (A: 31.7% vs. B: 10.8%, $P = 0.014$) whereas DGF and PNF showed no significant difference. Graft loss occurred during follow up in 21% ($n = 17$) and 16% ($n = 6$) of patients in groups A and B, respectively. Graft and patient survival rates in this subgroup were comparable for recipients with and without graft nephrectomy (Figs 2b and 3b).

Statistical analysis was performed on all 166 patients in the study to identify independent factors that were associated with graft lost after kidney retransplantation. Four factors were examined, including pretransplant graft nephrectomy (no graft nephrectomy vs. graft nephrectomy), percentage of panel reactive antibody (PRA >30% vs. PRA <30%; PRA >70% vs. PRA <70%), and occurrence of acute rejection. On multivariate analysis, pretransplant graft nephrectomy and a level of PRA >70% were independent risk factors that were significantly associated with graft lost after kidney retransplantation (Table 5).

Discussion

Kidney retransplantation is generally considered the preferred treatment option for patients with failure of the initial graft. Lack of consensus exists about the optimal management of the failed renal allograft in patients awaiting retransplantation. The rate of allograft nephrectomy performed prior to retransplantation varies greatly from 0.5% to 43% [6,12,13] depending on the protocol of the individual center. In most centers, the policy is to remove the failed allograft in patients with graft-related symptoms such as recurrent infections, hematuria, abdominal pain, adverse effects of immunosuppression, graft intolerance syndrome or if space is required for a subsequent transplantation. As Polyomavirus-associated nephropathy has emerged as an important cause of graft loss, nephrectomy to reduce viral loads prior to retransplantation might become another indication [14]. Although, controversy still exists whether failed graft removal affects long-term graft outcome after renal retransplantation. The practice of individually selected indication for graft nephrectomy has been challenged by several studies. Even patients without apparent clinical symptoms were found to suffer from a chronic inflammatory response syndrome and thus were at increased risk for further complications resulting in higher morbidity on hemodialysis which may affect the results of retransplantation [8,9]. This state of chronic inflammation might be ameliorated after allograft nephrectomy. On the other hand, perioperative morbidity and mortality of graft nephrectomy is considerably high. In recent studies, mortality was reported to range between 0.7% and 5% [15–17] and some earlier studies even reported mortality rates of 7.3% and 16.3% [18,19]. Another major concern is the fact that primary allograft nephrectomy might be detrimental for the new transplant by increasing PRA levels [6]. If the initial graft would be left *in situ*, the retained kidney might fix the circulating antibodies thereby protecting the new transplant.

Previous studies exploring the effects of transplant nephrectomy on the outcome of retransplantation have shown contradictory results. Abouljoud *et al.* [13] described an adverse effect of primary allograft nephrectomy on the outcome of the subsequent graft. They also found that lower donor age and an extended interval between allograft nephrectomy and retransplantation might improve the results of the subsequent graft. Sumrani *et al.* [7] also reported that nephrectomy of the initial graft was associated with a worse outcome after re-transplantation. They further hypothesized that transplant nephrectomy could be harmful to the new transplant by increasing PRA levels. This might be supported by the findings of a current study by Ahmad *et al.* [6] who showed that PRA level had a statistically significant influence on patient and graft survival. However, in their study this was irrespective of whether the patient underwent nephrectomy of the primary graft or not. Comparable findings were made by Douzdjian *et al.* [20] who observed higher PRA levels among patients who received

transplant nephrectomy, but this factor did not influence re-transplant outcome in their population. However, an increased rate of acute rejections was noted in patients with nephrectomy. Vanrenterghem and Khamis [21] reported in 1996 that the increase of PRA levels following allograft nephrectomy might be only transient. None of their patients was sensitized before nephrectomy. After nephrectomy 8.3% of their patients developed PRA levels >80%, but this effect was only transient and the number of PRA positive patients decreased again before retransplantation to 4.1%. This issue could be addressed by measuring PRA before and after elective allograft nephrectomy and every 3 month until re-transplantation. Another approach would be to continue immunosuppression for a period of time after the allograft nephrectomy to prevent this increase in PRA.

In our series, previous nephrectomy lead to increased PRA levels prior to re-transplantation which might be associated with a significantly increased rate of PNF and acute rejections in the postoperative course. There was also a tendency toward an increased frequency of DGF in the nephrectomy group. Not only was the early postoperative allograft function worsened but also overall survival of the subsequent graft was adversely affected by previous nephrectomy. We also performed subgroup analysis of two types of patients who might be at increased risk for inferior re-transplant outcome: patients who received allografts from donors older than 65 years of age and patients who underwent at least their second re-transplantation. In both subgroups, graft survival rates after re-transplantation were worse among patients who underwent nephrectomy prior to retransplantation compared with those who had not. Interestingly, when investigating the remaining ''low risk''-subgroup of our cohort – patients with neither one of the described risk factors – no impact of previous allograft nephrectomy on either DGF, graft or patient survival was found. However, previous nephrectomy was associated with increased numbers of acute rejections in this subgroup, probably caused by the elevated PRA levels which were clearly prevalent in patients who received transplant nephrectomy.

To the best of our knowledge, we report one of the largest cohorts to investigate the effect of failed allograft nephrectomy on graft survival after retransplantation. However, our study is suffering from several shortcomings – so did others before. Most of all patient background is not exactly equal between group A and B, because higher frequency of PNF or early graft failure within 6 months of previous graft and deceased donor transplantation were observed in the nephrectomy group. On average, patients of group A lost their first graft more than 2 years earlier than patients of group B which might indicate that the patients of group A were predisposed to high immunoreactivity. Correspondingly the average time they spent on hemodialysis prior to retransplantation was longer. However, it is not clear whether this might have affected the results of group A. Yagmurdur *et al.* investigated the effect of the time between previous and repeat transplantation on survival of the retransplant [5]. In their cohort, patients who underwent graft nephrectomy also had a longer interval to retransplantation. They suggested that longer hemodialysis time and longer time between successive renal transplantation represented risk factors for retransplant failure. On the other hand, studies have shown that the timing of nephrectomy in relation to retransplantation may be important for the new graft outcome and pre-emptive retransplantation has been found to have an inferior retransplant outcome [12]. Thus, a certain period of dialysis before retransplantation is supposed to be beneficial. The most current study by Ahmad *et al.* [6] did not show a difference in retransplant graft and patient survival between patients with or without hemodialysis prior to retransplantation. It has to be considered also that the patients who underwent nephrectomy suffered from graft-related complications and most likely were in a status of chronic inflammatory syndrome and therefore might have been predisposed to higher immunoreactivity. It is therefore difficult to conclude whether differences in outcome of retransplantation are related to graft nephrectomy *per se* or to other risk factors these patients might have borne. However, on multivariate analysis, besides PRA level ≥70% graft nephrectomy was the only independent risk factor for kidney graft loss after retransplantation in our patient population.

In summary, nephrectomy of the failed allograft was not beneficial for retransplant outcome in our series. Patients with failed graft nephrectomy tended to have a higher risk of PNF and acute rejection after rejection after retransplantation. For determination of graft nephrectomy and subsequent retransplantation indication, more precise information on patients' immunologic status has to be obtained. Besides measuring PRA before and after graft nephrectomy and prior to retransplantation, evaluation of DSA with and without complement-fixing ability should be performed to identify subgroups of patients at particular immunologic risk. Indication for failed allograft nephrectomy is then made on an individual basis considering the particular risk factors of each patient and providing an effective and tailored immunosuppressive strategy kidney retransplantation should be safely conducted anyhow, regardless of previous graft nephrectomy.

Conclusion

Recipients of renal retransplantation who underwent graft nephrectomy prior to retransplantation were compared

wthose who did not. Graft nephrectomy adversely affected initial graft function and long-term graft survival after retransplantation. Allograft nephrectomy should therefore be restricted to patients with relevant graft-related symptoms.

Authorship

CS: designed the study, analyzed the data and wrote the paper. HW: analyzed the data and revised the manuscript. LK and CA: collected the data. BS and NS: revised the manuscript. DP: designed the study and performed statistical analysis.

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