

DISCUSSION

The number of patients with end-stage renal disease is increasing every year. Most of them are on dialysis, but transplantation is the treatment of choice for many patients. Successful renal transplantation improves survival and quality of life.⁽⁸⁵⁾

Success of transplantation depends not only on surgery, but also on the management and nursing of post-transplant patients, and on the treatment of early and late complications after kidney transplantation.⁽⁸⁶⁾

Although many publications have discussed cadaveric kidney transplant surgical complications little data has been published about live kidney transplants.⁽⁸⁷⁾ In addition, universally accepted definitions, grading systems and guidelines for complications are lacking. Therefore, it is difficult to compare surgical morbidity and outcomes between different series to determine the incidence and management of these sequelae.⁽⁸⁷⁾

Indeed, many studies do not provide complete information about potential risk factors for global SCs during different stages of the transplant process.^(4, 88) Thus, the true incidence for overall SCs following kidney transplantation might have been underestimated.

In the current study, 55.7 % of our recipients are below 29 years, which is comparable to the median age of recipients at the time of transplantation in the literature.⁽⁸⁹⁾

In our study, the recipient gender ratio is the same as that reported by Eglė Dalinkevičienė et al.⁽⁸⁹⁾ Female donors are more than males in this study because most of them were the mothers of the recipients (74% of the donors were the mothers).

We find in our work the same types of pathology at the origin of the ESRD as those described throughout the literature. For example, Eglė Dalinkevičienė et al.⁽⁸⁹⁾ mentioned that chronic glomerulonephritis, diabetic nephropathy, polycystic kidneys and hypertensive nephropathy were causes of ESRD in 130 patients (88%).

The dialysis before transplantation is predominant in our study with only 2.9% of pre-emptive transplantation. Early diagnosis of ESRD and proper patient counseling helped in increased the chances of pre-emptive transplantation in the last five years.

In this current study, SCs are classified in different categories and risk factors are analyzed in each group individually, which may help to clarify the pathogenesis in each one.

Taken together, these factors could well explain an ongoing increase in the incidence of SCs following live kidney transplantation as observed in our study.

Post-transplant vascular complications are uncommon but important as they can result in significant graft dysfunction and may even result in loss of allograft.⁽⁶⁾

Renal vascular thrombosis occurred in seven recipients in our study with an incidence of 6.7%. Domingo Hernandez et al⁽⁴⁰⁾ demonstrated that renal allograft vascular thrombosis is a serious complication following kidney transplantation that ultimately leads to graft loss. The incidence of thrombotic complications (arterial or venous) in their study was 4.8%.

In our work, renal artery thrombosis results in graft loss in the seven patients; all of them had a single artery. The presence of multiple vessels makes the procedure more complicated as well⁽⁵⁾, although in our series, we did not find any arterial thrombosis in kidney graft with multiple arteries, similar findings to that presented in Antonopoulos et al study.⁽⁹⁰⁾

The underlying disease that causes ESRD in the patient also plays a role in the transplantation outcome.⁽⁸⁸⁾ In the current study, renal artery thrombosis was significantly developed in recipients who had obstructive uropathy as a cause of ESRD (p=0.002).

RAS may be a consequence of faulty surgical techniques, arterial damage during donor nephrectomy or kidney perfusion, kinking and compression of the renal artery.⁽⁹¹⁾ In our study, faulty techniques cause RAS in two patients while the other two are due to kinked renal artery.

The reported incidence of TRAS varies widely which maybe, in part, due to the fact that deterioration in allograft function is more commonly attributed to rejection and infection.^(92, 93)

Audarda V et al had reported an incidence of TRAS of 1.7%, when routine postoperative Doppler evaluation was not in vogue. After the introduction of routine postoperative Doppler evaluation since 2002, they reported an incidence of 7.9% of TRAS.⁽¹⁴⁾ In our present series, three out of four patients present with RAS underwent transplantation after 2010 (3 out of 36 transplants) with an incidence of 3.8%. The reasons could be multifactorial. A high index of clinical suspicion, the extensive workup of evaluation for TRAS and different levels of surgical expertise may all play a role in increased detection rate.

In their study on long term outcomes of different treatment methods on 23 patients with TRAS, Sankari *et al.* from Cleveland clinic observed that 16 out of 23 patients (75%) required angioplasty and 5 required surgical revascularization.⁽⁹⁴⁾ About 75% of them showed improvement with respect to hypertension and 69% had an overall improvement in allograft function. In our series, the two recipients who required intervention showed an overall improvement in blood pressure and renal function.

The adverse effects of hemorrhagic crises on patient and graft survival are as serious as thrombotic and stenotic complications. Because it is a significant factor in the development of hemorrhagic complications, grafts with multiple renal arteries should be managed with care during bench preparation and surgical suturing.⁽⁹⁵⁾

Generally vascular anastomosis in renal transplantation should be performed meticulously, so that the deleterious impact of vascular complications can be avoided.⁽⁶⁾

In our study, the incidence of post-transplant hemorrhage is 7.7% that is lower than that mentioned by Domingo Hernandez⁽⁴⁰⁾ "Hemorrhagic complications occurred within the first 48 h after surgery in 128 patients (14.7%) and many of them underwent re-intervention (44%)". However, it is plausible that a laborious bench surgery performed in the presence of vascular injuries or multiple renal arteries may be a risk factor for bleeding, as observed in our study.

Our study demonstrates an incidence of urological complications (12.5%) in a cohort of renal transplant patients who had living donors and who underwent transplantation in the same center using the same technique for ureteral reimplantation.

The incidence of urological complications in large series is 2.6-15%. This wide range probably reflects the method of reporting; some authors do not include lymphoceles as a urological complication, and others include urinary tract infection (UTI).⁽⁹⁶⁾ Furthermore, the complication rate was slightly higher in the patients who received kidneys from living donors than in those who received organs from cadavers.^(40, 97) This is presumably the result of more extensive hilar dissection required during harvesting from the living donor, with the attendant risks of injury to the blood supply of the ureters.⁽⁹⁷⁾

Shokeir et al⁽⁹⁸⁾ concluded that the type of restoration of urinary continuity is the only factor that affected the incidence of surgical complications on multivariate analysis, with the best results achieved with the use of the extravesical Lich-Gregoire technique.

In this current study, grafts from older donors (above 40 years) had significant risk of development of post-transplant urinary fistulae (p=0.042) which is comparable to the results published by Karam G et al.⁽⁹⁹⁾

Ureteric obstruction may occur in either the early or the late postoperative period, while ureteral fistulae are generally evident early after transplantation⁽¹⁰⁰⁾

Despite the continuous improvements in harvesting and ureteral reimplantation techniques, ureteral stenosis following kidney transplantation. (2.8% in our series) remains the most common long-term urological complication⁽¹⁰¹⁾, ranging from 0.5 to 6.3% in the recent literature.⁽⁴⁸⁾ Ureteral obstruction is related to a variety of etiologies such as ureteral ischemia, ureteral kinking or peri-ureteral fibrosis and may be located in any portion of the ureter.^(102, 103) However, the distal ureter and the ureterovesical areas are particularly vulnerable. This is evidenced by previous reports (60–95% of anastomotic stenosis⁽¹⁰⁴⁾ and by our study (66.6%).

Generally, most donor ureteral obstructions are distal, and often involve the ureterovesical junction. Distal ischemia is the most common cause of distal stricture formation.^(43, 105)

Trauma to the renal artery during donor nephrectomy, as caused by excessive traction on the renal vessels during nephrectomy can result in distal ureteral ischemia.⁽⁴³⁾

Ureteral stenosis is probably caused by local ischemia from a decreased vascularization or as a tissue reaction in case of a rejection process. There is a higher frequency of urinary leakage in living related donors that could be explained by the fact that the vascularization of the ureter is more easily damaged during living donor nephrectomy.^(97, 104)

The urinary anastomosis was stented with a double J ureteral catheter in 38.5% of our cases. Seven out of ten patients presented with ureteral leakage in our series had undergone unstented ureteroneocystostomy ($p=0.042$). There may be advantages of stenting that are not evident in the analysis of complications. There is no doubt that the primary benefit is the ease and precision of performing the anastomosis.⁽¹⁰⁶⁾ We find that ureteric stenting assures mucosa-to-mucosa anastomosis without causing inadvertent obstruction. Additionally, an indwelling stent excludes leak, obstruction or transient edema as causes of early post-operative oliguria. Other studies have shown that stents decrease the rate of other urologic complications in adults.⁽¹⁰⁷⁾ There are some disadvantages to stenting, including the potential for an increase in urinary tract infections, though one adult study found no difference.⁽¹⁰⁸⁾

Role of routine ureteric stenting is debatable in literature.⁽¹⁰⁸⁾ Kumar evaluated the effect of ureteric stenting in prospective randomized study and concluded that routine placement of stent was cost effective and almost eliminate urological complications.⁽¹⁰⁷⁾

Many studies^(109, 110) have shown that routine use of JJ stents in kidney transplantation significantly reduced the number of early urinary fistulae and it was found to be similar to our experience with JJ stent.

Lymphocele diagnosed by postoperative ultrasound occurred in 9 of our patients (8.8%), this incidence is similar to the general incidence of 1-18% reported in the literature⁽¹¹¹⁾, but it was symptomatic in only five patients (4.8%) which is nearly identical to that in other large series⁽⁶⁷⁾ requiring either U/S guided aspiration, open or laparoscopic marsupialization in two, two and one recipients respectively with favorable outcomes.

The laparoscopic approach first was described in 1991 and has been reported as successful treatment of post-transplant lymphoceles in adults.⁽¹¹²⁾ The potential benefit of this approach is minimization of surgical trauma, avoidance of wound complications and ileus, and immediate oral intake after the operation, especially oral immunosuppression drugs.⁽¹¹³⁾

In the current study, graft survival rate is 76.9% at one year, 76.4% at 3 years, 77.2% at 5 years, 79% at 10 years, 65% at 15 years, 40% at 20 years and 25% at 25 years post-transplant.

Table (XVIII): Graft survival in different studies and the current study

| References | Number of cases | Graft survival | Our study | Number of patients | Graft survival |
|-------------------------------|-----------------|-----------------|-----------|--------------------|------------------|
| - | - | - | 1990 | 4 | 25% 25 year |
| Ojo Ao ⁽¹¹⁴⁾ | 203 | 86% 10 year | 2005 | 43 | 79% 10 year |
| Pillot P ⁽¹¹⁵⁾ | 49 | 88.7% 5 year | 2010 | 88 | 77.2% 5 year |
| Cedars Sinai ⁽¹¹⁶⁾ | 122 | 88.5% 3 year | 2012 | 102 | 76.4 % 3 year |

To our knowledge, there are no data about 25 or even 20 year graft survival rate of living kidney transplant in the literature.

Analysis of data from the literature on the survival of patients allows distinguishing three periods. The first period corresponds to the (90 s), with the beginning of renal transplantation in Alexandria experience with rather disappointing results compared to those in literature. The second period corresponds to the (2000) where the teams were more trained and the rate of transplantation increased. The results in terms of graft survival began to be encouraging. The last period is the (after 2010) with the graft survival rates in our series become comparable to the large series in literature.⁽¹¹⁴⁻¹¹⁶⁾

Graft loss (defined as return to dialysis, graft nephrectomy) due to surgical complications occurred in seven cases in our study (25.9% of cases of graft loss), all are due to renal vascular thrombosis, while the major factor of graft loss in our population is chronic rejection (74.1% of cases of graft loss). This observation and that in the literature confirm that the natural history of renal transplantation is more or less long-term rejection and chronic allograft nephropathy.^(86, 93)

The results of the present study of living kidney donors showed that they had a high prevalence of stage 3 CKD after donation (24.8%) according to the recommended eGFR calculator, the abbreviated MDRD equation, as previously described.⁽⁸³⁾

Unfortunately, there are relatively few published data on kidney function in normal population stratified by age.⁽¹¹⁷⁾ Horio et al⁽¹¹⁸⁾ have recently evaluated the performance of the Japanese GFR equation in potential kidney donors.

Although most of our work is a retrospective study which constitutes an important limitation, it gives us the chance to evaluate the strengths, weaknesses, opportunities and threats involved in our renal transplant program (SWOT analysis).⁽¹¹⁹⁾

SUMMARY

The preferred modality for renal replacement is renal transplantation. Survival rates have improved because of refined surgical techniques, more effective immunosuppression with medications.

Surgical complications remain an important potential cause of graft dysfunction and /or graft loss after kidney transplants.

Vascular complications include renal artery stenosis, renal vascular thrombosis and post-transplant hemorrhage. Nonvascular complications include ureteral obstruction, urine leak, neoplasms and post transplantation lymphoproliferative disorder.

Regarding vascular complications, Doppler ultrasound should be the initial diagnostic modality. Others modalities are multidetectors helical CT and MRI with gadolinium. Treatment options for vascular complications include both surgical and endoluminal options. Surgical repair and endourological techniques are offered to post-transplant urologic complications.

Our study aimed at studying the surgical complications of renal transplantation in Alexandria University and to correlate them to patients' outcomes .A retrospective study upon 104 couples during the period from June 1990 to December 2012. All of the recipients and their donors were followed up till June 2014 with a limitation of incomplete recording of peri-operative research data.

The most common recipient age at transplantation was between 20-30 years (49%) with the median age (29 years). End-stage renal failure was due to non-surgical causes in 99 recipients (95.2%).

Twenty two recipients (21%) were scheduled for hemodialysis in the first post-operative week.

Overall there were forty one surgical complications in thirty seven recipients, an incidence of 35.5%. Nineteen vascular complications developed in 17 patients and 11 recipients had 13 urologic complications. Lymphocele was post-operatively diagnosed in nine recipients.

RAT, RAS and post-transplant hemorrhage occurred in seven, four and eight patients (6.7, 3.8 and 7.7%) respectively. In this study, RAT was significantly developed in the recipients who had obstructive uropathy as a cause of ESRD ($p=0.002$).

Medical causes of ESRD in our recipients were significantly associated with the development of urinary fistulae ($p=0.0333$). Grafts from older donors (above 40 years) had significant risk of development of post-transplant urinary fistulae ($p=0.042$). Non-stented ureterovesical anastomosis resulted in more urinary leakage than stented one ($p=0.042$).

Both medical causes of ESRD and long cold ischemia time were significantly associated with the development of post-transplant lymphocele ($p=0.0401$ and 0.033 respectively).

In this current study, six out of eleven recipients developed post-transplant urologic complications had serum creatinine more than 2 mg/dl, an observation which was statistically significant.

It was found that all surgical complications mentioned had no statistically significant impact on the graft survival.

In regard to the donors, follow-up program was adopted to monitor changes in serum creatinine, eGFR, development of proteiurea and /or hypertension.

As a conclusion, Proper and adequate medical registration is essential for quality of medical and health care services. To achieve a successful and complication-free transplantation, a team-work between urologist, nephrologist, pathologist, radiologist and specialist in nuclear medicine is a pre-requisite.