

Factors Affecting Length of Hospitalization in Kidney Transplant Recipients

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Objectives: Owing to improvements in surgical techniques and clinical care, many of the earlier difficulties surrounding kidney transplants have been overcome and so, the number of operations performed has increased dramatically. Resource utilization and costs are now cited as problems for some transplant centers. Because length of hospitalization accounts for the largest portion of the total cost of the treatment process, we sought to determine and assess the factors that might reduce its length.

Materials and Methods: We retrospectively studied the medical histories of 115 kidney transplant recipients and donors whose operations were performed between May 2000 and April 2002. Collected information for the recipients included sex, age, reason for kidney failure, weight, height, blood group, length of pretransplant dialysis, number of prior transplants (1 or 2), immunosuppressive regimen, postoperative complications (ie, lymphocele, wound infection, urinary tract infection, graft rejection), and hospitalization after the first discharge owing to postoperative complications. For donors, these demographics included age, sex, blood group, type of donor (deceased or living), and relationship to the recipient.

Results: Length of pretransplant dialysis and relationship of the donor to the recipient were independently associated with predicting an increased length of hospitalization (and consequently, increased costs).

Conclusions: By reducing the length of pretransplant dialysis (wait time) and performing more operations between related donors and recipients, the length of hospitalization as well as the cost of treatment can be significantly reduced. Given the results of this study and owing to the increasing number of transplant surgeries occurring globally, future research should focus on analyzing other factors that affect length of hospitalization and associated costs.

Key words: *Related donors, Wait time, Dialysis period, Weight, Sex*

As problems confronting kidney transplant recipients have been solved, and kidney transplant is considered a routine operation in many hospitals worldwide, the number of operations performed has increased dramatically. However, along with an increasing number of transplants as well as improvements in medical technology and techniques that allow patients with more-complicated diseases the possibility of kidney transplant, financial issues are being reported as a new problem for many transplant centers [1-3]. Reducing the costs associated with transplants is one of the highest priorities currently facing transplant centers. Much research has been performed to address this issue.

Various factors including drug costs and the immunologic characteristics of recipients and donors have been considered responsible for increasing the costs of treatment [4, 5]. Some investigators have sought to decrease treatment costs by analyzing the pretransplant factors that decrease or increase complications (eg, graft rejection and delayed graft function) associated with the operation [6]. However, the largest portion of the total cost of the treatment process is length of hospitalization [7]. Length of hospitalization is proportional to the number of medical procedures performed on the patient, all of which are costly. Because length of hospitalization is an important factor when estimating the total cost of treatment [2, 8], we sought to determine and assess the factors that might reduce its length.

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Experimental and Clinical Transplantation (2007) 1: 614-617

The length of hospitalization itself is determined by different factors. Previous studies have examined a patient's weight, sex, and age as influencing factors [1]. In this study, we sought to determine and assess *preoperative factors* that might reduce the length of hospitalization [7, 9]. Only in this way could we predict the cost of a transplant.

Materials and Methods

We retrospectively studied the medical histories of 115 kidney transplant recipients (66 men, 49 women; mean age 36.8 years, age range, 11-72 years) and donors whose operations had been performed between May 2000 and April 2002. Collected information for the recipients included sex, age, reason for kidney failure, weight, height, blood group, length of pretransplant dialysis, immunologic characteristics, number of prior transplants (1 or 2), immunosuppression regimen, postoperative complications (ie, lymphocele, wound infection, urinary tract infection, graft rejection), and hospitalization after the first discharge owing to postoperative complications. For donors, these demographics included age, sex, blood group, type of donor (deceased or living), and relationship to the recipient. While transplant from live, voluntary donors is the standard in Iran, most donors are not close relatives of the recipients.

Weight was measured in kilograms. A standard immunosuppressive regimen consisted of cyclosporine, corticosteroids, and mycophenolate mofetil triple therapy. Cyclosporine (10 mg/kg) was prescribed orally before the transplant. The dosage was individually adjusted to maintain cyclosporine trough levels within the following ranges: days 0 to 14 after transplant, 200 to 300 ng/mL; weeks 3 to 12 after transplant, 150 to 250 ng/mL; and thereafter, 100 to 200 ng/mL. Cyclosporine trough levels were determined as 12-hour whole blood concentrations. Oral mycophenolate mofetil was started immediately after transplant at 2 g/day, in 2 or 4 divided doses with dosage adjustments based on adverse effects such as gastrointestinal toxicity or myelosuppression. No attempt was made to intentionally lower the mycophenolate mofetil dosage in the absence of toxicity. Recipients received methylprednisolone (1 g) intraoperatively and on days 1 and 2 postoperatively, followed by a corticosteroid taper (to 0.5 mg/kg) through day 14. The prednisolone dosage was further reduced to 10 mg daily over 6-month period.

Antilymphocyte serum and methylprednisolone pulse therapy were used to treat acute rejection. For prophylaxis, co-trimoxazole (sulfamethoxazole 400 mg and trimethoprim 80 mg) was administered every day during the first 6 months after transplant. Recipients with a history of rejection were considered as receiving a "second transplant." We considered first-degree relatives to be *family donors*.

Rehospitalizations that were due to late complications (complications due to the transplant that occurred later than 10 days after discharge from the first hospitalization), were not considered part of the hospitalization period. The dialysis period was the number of months the patient had been undergoing dialysis prior to transplant. Prior to the study, the study protocol was approved by the ethics committee at Mashhad University of Medical Sciences, and the protocol conforms with the ethical guidelines of the 1975 Helsinki Declaration. Written informed consent was obtained from all subjects.

Results

Individual variables were analyzed with the *t* test and the Pearson product moment correlation analysis to assess their association with the length of hospitalization. The recipient's sex was not related with length of hospitalization (Figure 1) ($P = .874$). B Rh-positive was the most common blood group among the recipients; however, this variable was not significantly associated with length of hospitalization ($P = .250$). Age was not significantly associated with length of hospitalization ($P = .382$). Mean body mass index (BMI) was 20.54 (range, 12.9-32.05); no

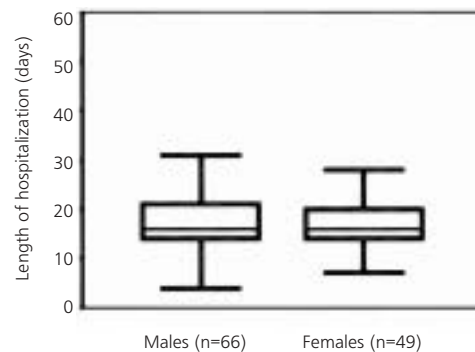


Figure 1: Length of hospitalization according to sex

significant association was found between BMI and length of hospitalization ($P = .163$). Recipients' weights were also assessed, and no significant relationship was found for this variable either.

Figure 2 shows the relationship between length of hospitalization and length of dialysis prior to transplant. The Pearson product moment correlation analysis showed that length of dialysis was statistically significantly related with length of hospitalization ($P = .006$). There were 85 nonrelated donors and 16 related donors, and this relationship was statistically significant ($P = .001$).

Analyses of the donors' sex showed no significant relationship with length of hospitalization ($P = .361$). O was most frequent blood group in the donors, but this blood group was not statistically significantly related with length of hospitalization ($P = .250$).

Because there was a nearly statistically significant

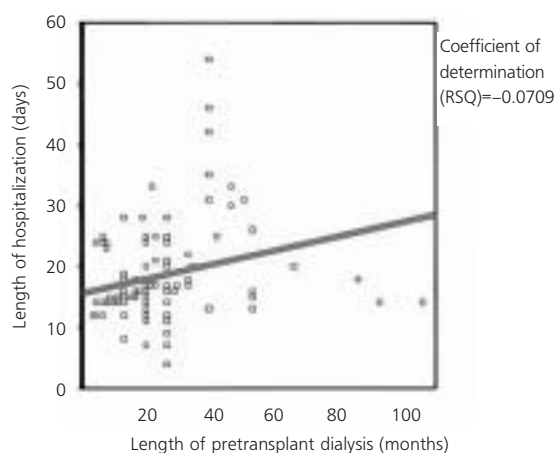


Figure 2: Relationship between length of hospitalization and length of pretransplant dialysis

correlation between length of dialysis and relationship between donor and recipient, we put these 2 variables into a regression model to estimate their impact on one another. We found that if we assume the pretransplant dialysis period to be ineffective, having a related donor decreases the length of hospitalization by slightly more than 4 days. If we consider the relationship between donor and recipient to be ineffective, then length of hospitalization increases 0.113 days for each month of pretransplant dialysis.

Discussion and Conclusions

Along with an increase in the number of transplants owing to surgical innovations, and the acceptance of more patients with complicated diseases as reasonable candidates for transplant, comes the issue of resource management. Since the number of transplants rose at a faster rate in Western countries, this issue was dealt with earlier, and consequently, much research in this area has already been conducted. In the Middle East, however, this stage has only recently been reached. Regarding this “new” problem for Middle Easterners and the fact that resource allocation for such treatment in our countries is different from that of most Western countries, we decided to take a first step in analyzing the costs associated with transplant. We decided to study factors that might decrease the length of hospitalization for transplants and thus, decrease the overall costs of the treatment.

Because highly expensive drugs are used in kidney transplants, many researchers have focused on how the prices and effects of drugs affect length of hospitalization [4, 5]. However, we wanted to look at *preoperative factors*.

Weight is another factor that has been previously studied. Some studies have concluded that weight has a negative impact on transplant outcomes, while

other researchers have found no significant differences regarding outcomes between obese and nonobese patients. However, almost all studies on adult recipients have shown a significant relationship between weight and an increase in postoperative complications, which can increase the length of hospitalization and consequently, the cost of the transplant [10-15]. The same problem has been shown in child transplant recipients [16]. Another study [1] found that weight was a factor only in female recipients. Some studies [14, 17] have assessed the weight of the donors and its effect on transplant outcomes, but since the donors of our patients were not available, we lacked the necessary data to assess this factor. BMI between donors and recipients also has been studied, but no significant effects have been shown for this factor [17, 18]. Our study failed to show a significant relationship between weight before transplant and length of hospitalization. We also assessed BMI, but this factor did not show a significant relationship either.

Length of pretransplant dialysis is another factor that is important with regard to not only the costs and length of hospitalization but also to the general outcome of the operation. Now that researchers are studying and performing transplants in recipients who have not undergone prior dialysis [19, 20], the role of the dialysis period with regard to total costs will be more evident.

Our results as well as others' show a significant relationship between length of pretransplant dialysis and length of hospitalization [21, 22]. Therefore, reducing the dialysis interval can decrease transplant costs. Some of the reasons for lengthy dialysis periods before transplant are long waiting lists and increased demand for donors. Managing a waiting list has been shown to be expensive [23]. Incentives for donors provided by governmental and nongovernmental organizations can increase donations. Paying donors or providing them with incentives (eg, free medical insurance) is an effective means of increasing donations and decreasing costs [24, 25]. In addition to the factors that help us predict and reduce the length of hospitalization, approaches that directly decrease this period, such as intensive outpatient treatment [26], also can reduce costs.

In conclusion, living-related donors and length of pretransplant dialysis were shown to affect the length of hospitalization required for transplant. We suggest that by reducing the duration of dialysis treatment and by using living-related donors more frequently, we can significantly decrease the hospitalization period and as a result, decrease the costs of transplant.

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