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Murat Zeytunlu , Alper Uğuz , Ömer Ünalp , Orkan Ergün , Zeki Karasu , Fulya Günşar , Ulus Akarca , Funda Yılmaz , İlker Turan , Deniz Nart , Fatih Tekin , Ömer Özütemiz, Sezgin Ulukaya, Nuri Deniz , Sema Aydoğdu , Funda Özgenç , Ezgi Taşçı , Rüçhan Sertöz, Mustafa Parıldar , Nevra Elmas, Mustafa Harman, Ezgi Güler, Erkan Kısmalı, Rahmi Akyol, Tansu Yamazhan , Meltem Taşbakan , Yiğit Tiftikcioğlu , Feza Bacakoğlu, Sanem Nalbantgil , Ayşin Noyan , Bülent Karapınar , Arda Kılınc , Mehmet Uyar , Kubilay Demirağ , Sibel Özalp , Nebile Özdemir, Sinem Aras, Nurşen Altuğ

Liver Transplantation Department of Organ Transplantation and Research Center, Ege University School of Medicine, İzmir, Turkey

**Cite this article as:** Zeytunlu M, Uğuz A, Ünalp Ö, et al. Results of 1001 liver transplantations in 23 years: Ege University experience. *Turk J Gastroenterol* 2018; 29: 664-8.

## ABSTRACT

**Background/Aims:** Liver transplantation (LT) is now the standard of care for most end-stage liver diseases. Over the next 30 years, advances in medicine and technology will greatly improve the survival rates of patients after this procedure. The aim of the present study was to analyze retrospectively the results of 1001 patients with LT.

**Materials and Methods:** Medical reports of 989 patients were analyzed retrospectively. Data were obtained from the patient's data chart. Descriptive statistics were used to describe continuous variables (mean, median, and standard deviation).

**Results:** A total of 1001 LTs for 989 recipients were performed at Ege University Organ Transplantation and Research Center between 1994 and 2017. There were 639 male and 350 female recipients. Among 1001 LTs, there were 438 deceased donors and 563 living donors. The age interval of the patients was 4 months to 71 years old. The median Model for End-Stage Liver Disease score was 20. There were 12 deceased liver donors using the split method. There were 12 cases subject to retransplantation. In living donor LT grafts, 423 right lobes, 46 left lobes, and 94 left lateral sectors were used. In the first monitoring, the total annual mortality rate was 130 cases (13%). The mortality rate in retransplantation was found to be 66%. A 1-year survival rate of 87% was generally established.

**Conclusion:** LT has been improving consistently over the last two decades. Ege University is one of the biggest liver transplant centers in Turkey for both technical and educational perspective.

**Keywords:** Liver, liver transplantation, living donor liver transplantation, HCC, cirrhosis, acute liver failure

## INTRODUCTION

Liver transplantation (LT) is the standard of care for most end-stage liver diseases in adult and pediatric patients. In 1958, the orthotopic LT technique in dogs was described by Moore et al. (1). The first LT in a 3-year-old boy with biliary atresia was performed by Starzl et al. (2) in 1963, but the child died intraoperatively from coagulopathy and surgical complications. In 1967, the same group began a successful series of LTs (3). Until 1977, 200 LTs were performed worldwide. In that period, technical problems were overcome. In 1979, cyclosporine was used in two patients during LT (4). Over the next 20 years, advances in preoperative care, patient selection, surgical tech-

niques, anesthesia critical care, and immunosuppressive regimen for LT have led to dramatically improved outcomes in both adult and pediatric patients. In 1989, Starzl et al. (5) reported a series of 1179 consecutive LT patients and revealed a survival rate of 73% and 64% between 1 and 5 years, respectively. Finally, in 1990, Starzl et al. (6) published the successful use of tacrolimus in patients undergoing LT and who had rejection despite receiving conventional immunosuppressive treatment. In 1984, the first reduced-size LT was performed by Broelsch et al. (7) in the USA and Bismuth et al. (8) in France. Pichlmayr et al. (9) reported the first split LT in 1988. With the increasing number of patients in the waiting list, transplan-

**ORCID IDs of the authors:** M.Z. 0000-0001-6911-8953; A.U. 0000-0001-8127-5644; Ö.Ü. 0000-0002-4318-9646; O.E. 0000-0003-4046-3782; Z.K. 0000-0002-4974-7944; F.G. 0000-0002-6002-4819; U.A. 0000-0002-7020-5816; F.Y. 0000-0001-5038-8734; İ.T. 0000-0001-8998-1965; D.N. 0000-0002-8100-6978; F.T. 0000-0002-7282-1399; N.D. 0000-0002-6455-9132; S.A. 0000-0002-1678-7552; F.Ö. 0000-0002-0222-8725; E.T. 0000-0001-8599-7660; M.P. 0000-0002-4800-0283; T.Y. 0000-0001-5950-0702; M.T. 0000-0002-4689-720X; Y.T. 0000-0002-4573-3844; S.N. 0000-0002-9798-9796; A.N. 0000-0003-0330-9655; B.K. 0000-0002-6034-189X; A.K. 0000-0001-9493-4055; M.U. 0000-0003-3511-7682; K.D. 0000-0003-2933-6977; S.Ö. 0000-0001-5692-3531.

Corresponding Author: Murat Zeytunlu; muratzeytunluomer@gmail.com

Received: March 1, 2018 Accepted: May 15, 2018

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DOI: 10.5152/tjg.2018.18058

"See Editorial Comment 629-30"

tation of partial liver grafts from living donors was found to increase the donor pool. For this purpose, Broeschl et al. (7) established the technique of segmental living donor transplantation. In 1989, Strong et al. (10) performed the first successful living donor LT. The first successful adult-to-adult living donor LT was performed by Shinsu group in 1993 (11). Following the Shinsu group, the Tokyo group performed left lobe transplantation for an adult recipient (12). In 1996, Lo et al. (13) were the first to perform LT using an extended right lobe from a living donor for an adult recipient. In 2002, Cherqui et al. (14) reported the first donor hepatectomy using a full laparoscopic procedure in which a left lateral lobectomy was successfully performed in a child. The first liver transplant in Turkey was performed by Haberal et al. (15) in 1988. The first successful partial living donor liver transplant in children in Turkey was performed by the same team in 1990.

Between 1994 and 2017 (as of today), a total of 1001 LTs were performed at Ege University. Our program was started in 1994 for an adult female recipient with a cadaveric full-size graft. In 1999, we started our living donor program, and 11 cases were performed on that year. As one of Turkey's leading centers in LT, we would like to present an account of our first 1001 cases and a reflection on our experience.

**MATERIALS AND METHODS**

In 23 years of experience, a total of 1001 LTs were performed. Medical reports of 989 patients were analyzed retrospectively. Data were obtained from the patient's data chart. No approval was needed from the local ethics committee since this was a retrospective study. Written informed consent was provided by all the patients who participated in the study. Descriptive statistics were used to describe continuous variables (mean, median, and standard deviation).

**RESULTS**

A total of 1001 LTs for 989 recipients were performed between 1994 and 2017. There were 639 (64%) male and 350 (36%) female recipients. In the adult group, the total number of patients was 810 with 537 (66%) male and 273 (34%) female recipients. In the pediatric group, there were 101 (56%) boys and 78 (44%) girls. The age interval was observed at 4 months-71 years (median 47years). The mean Model for End-Stage Liver Disease score was 22.3(ranging between 9 and 50, median 20) for adult patients. There were 438 (43%)liver transplants from cadaveric organs and 563 (57%) liver transplants from living donors. In the adult group, 462 (56%) living

donor LTs and 356 (44%) cadaveric LTs were performed. In the same period, a total of 183 pediatric LTs were performed. Of these transplants, there were 101 (55%) from living donors and 82 (45%) from cadaveric organs. There were 12 cadaveric organs using the split method. In living donor LT grafts, 423 right lobes, 46 left lobes, and 94 left lateral sectors were used (Figure1). In the first monitoring, the total annual mortality rate was 130 (13%) out of 898 recipients. There were 12 cases subject to retransplantation (1.2%). The total numbers of retransplantation were 4 for the pediatric group and 8 for the adult group. Of those, 7 required emergency care within 30 days, whereas 3 required retransplant in the first year and the other 2 after 1-2 years. The mortality ratio of retransplantation was observed at 66%. A 1-year survival rate was found to be 87% in general.

When we analyze the total results according to indications, the highest ratio belonged to liver diseases stemming from viral etiology as valid for the country in general. In the adult group, the most frequent etiology was cirrhosis at 64% (Figure2). Cholestatic diseases constituted 9%, acute liver failures 9%, metabolic diseases 4%, and

**LIVE DONOR GRAFTS FOR 563 CASES**

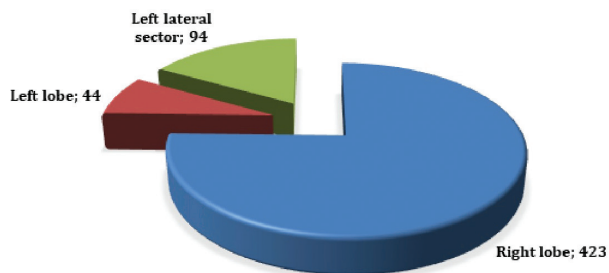


Figure 1. Graft type for living donor liver transplantation

**ETIOLOGY FOR ADULT LTx**

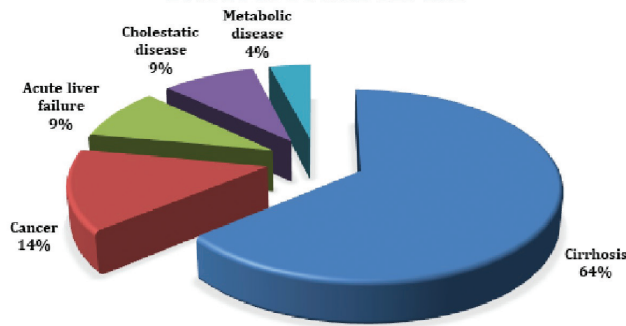


Figure 2. Etiology in adult recipients for liver transplantation

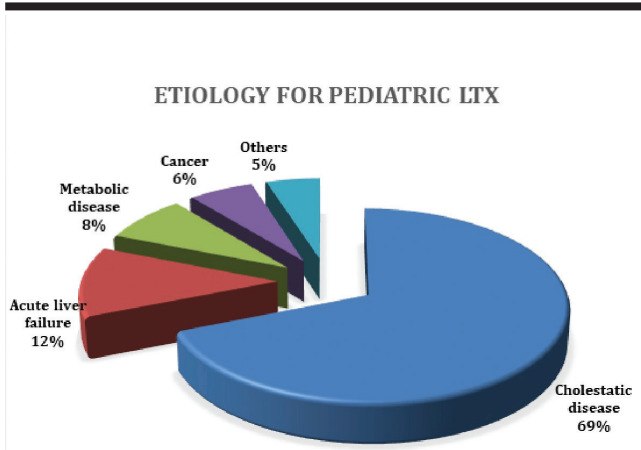


Figure 3. Etiology in pediatric group for liver transplantation

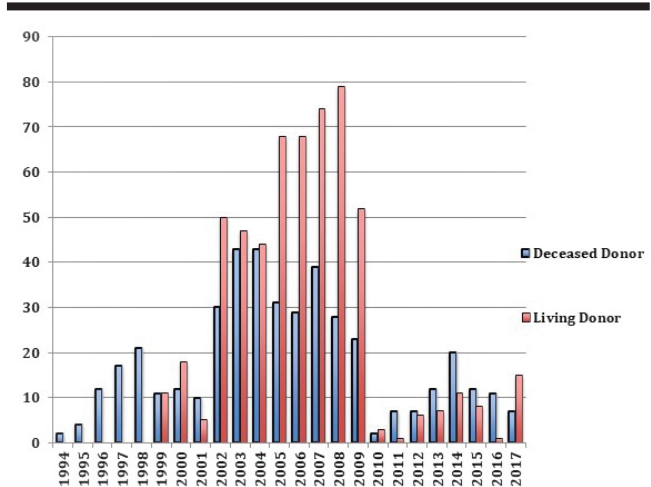


Figure 5. Living and deceased donor liver transplantations per year

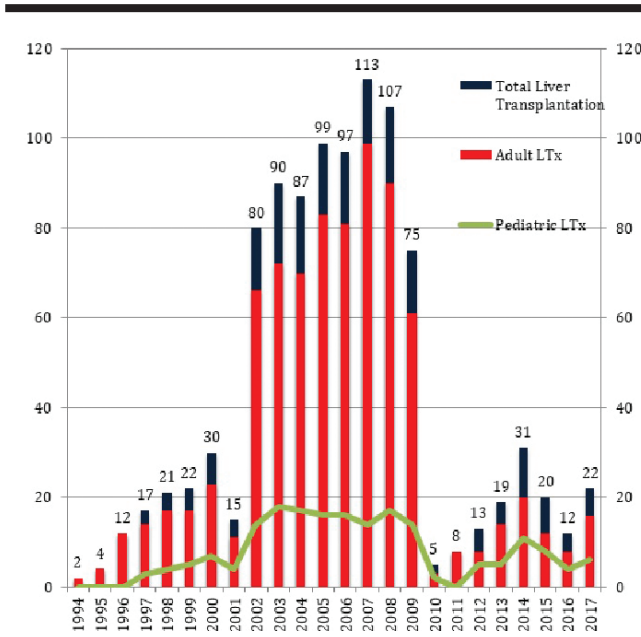


Figure 4. Number of liver transplantations per year

Figure 4 and 5 show the breakdown of operations according to years.

### DISCUSSION

Our program that started with cadaveric LT in 1994 gained momentum especially after 1998 and became one of the leading LT programs in Turkey. The living donor program started in 1999 with a right lobe adult living donor transplant (16). Especially owing to the multidisciplinary approach, a systematic program was developed that turned our center into one of the most important institutions providing service and education in this respect. Within the LT center, surgery, anesthesiology, gastroenterology, radiology, interventional radiology, psychiatry, pediatric gastroenterology, microbiology, infectious diseases, biochemistry, and all other clinical and preclinical branches are available. The LT Council, which was initiated as a joint decision mechanism starting from the first moments of this journey in 1994, convenes regularly for every patient, and the decisions are evaluated by the Council in connection with the side consultations. Especially, preoperative preparations constitute a significant part of LTs. Doubtlessly, accurate indication and well-prepared procedure will be more prone to success. With the initiation of the living donor program in 1999, the preoperative preparation process has become more important. Nowadays, ensuring the safety of the living donor is the basis of the entire programs. For the 563 living donor operations performed until now, the mortality rate is 0 (17,18). Similarly, a regular preparatory process is a significant parameter for attaining positive results. Through a multidisciplinary study, the center has turned out to be as one of the most experienced centers in pediatric cases as well. For the

cancers 14%. As valid for the population of our country, among the viral etiologies, the majority was from cirrhosis caused by hepatitis B (62%). In the pediatric group, the most frequent etiology was cholestatic diseases at 69%, followed by metabolic diseases (8%), cancers (6%), acute liver failures (12%), and cirrhotic situations (5%). Majority of the cholestatic diseases in pediatric patients were biliary atresia and progressive familial intrahepatic cholestasis (Figure 3).

pediatric receivers who are difficult and sometimes impossible to find a cadaveric graft, LTs from suitable living donors introduced a new hope of life (19). The pediatric liver transplant program started with cadaveric transplant in March 1997, and living donor transplants increased after December 1999 (20,21).

In this 23-year process in terms of education, our center was the first to provide education to various types of specialists, such as surgeons, anesthesiologists, gastroenterologists, pathologists, pediatric and gastroenterologists, working in different parts of Turkey in several centers. When we take a look at the figures, it would not be wrong to say that teams that have worked as specialists or fellows in Ege University's LT center performed >50% of the LTs throughout the country.

According to the 2016 data of the Ministry of Health, the number of patients awaiting LT is >2000 annually. The number of LTs performed is approximately 1200 per year. In conditions in which cadaveric grafts are not sufficient, living donor LT is the most significant source of hope for patients awaiting LT. The most significant issue in living donor LT is the safety of the donors. In our program that was initiated in 1999, at the beginning, the residual volume was tested to be >40%, but with increasing knowledge and experience as well as technological improvements, the minimum limit has been accepted as 30% in our center, similar to the examples worldwide (18). Preparation of fully healthy and psychiatrically reliable voluntary individuals to become a donor requires a meticulous and serious process. In case of minor doubt, the safety of the donor is the priority in both preoperative and operative processes. Preoperative, operative, and postoperative monitoring of the donor is undertaken as a standard, and donor's continuation to his/her life without any problem is ensured through regular controls by the same team after being discharged from the hospital.

Among the standards applicable for the receivers in general, the 0.8-1.00 interval is used for the graft weight-to-body weight ratio. However, it can sometimes be possible to decrease to 0.6% under designated conditions. One of the most important pillars of living donor LT is arterial reconstruction. Microsurgery is used in our center for arterial reconstruction similar to other high-volume centers worldwide. With this process, the arterial thrombosis ratio is only <1% in living donor LTs. Biliary anastomosis, termed as the heel of Achilles by Roy Calne, is successfully managed in our center with the aid of invasive endoscopic retrograde cholangiopancreatography and inter-

ventional radiology departments (22,23). The availability of experienced gastroenterology and interventional radiology teams in the university ensures the highest level of reliability for living donor LTs. The existence of a wide and experienced staff ensures more reliable operations for multiple variations that need reconstruction. Donor variations are primarily evaluated from the perspective of the donor, and multiple artery and biliary reconstructions are performed for the receiver with the help of microsurgery and other teams if it does not constitute a risk for the donor. The most important treatment option accepted as curative today in treating hepatocellular carcinoma is LT (24). Although surgical resection is implemented for cases with normal liver functions, disease-free survival is nearly 0%-45% for 5 years. Together with LT, performed within the defined criteria, the ratios increase from 60% to 90%. LT offers excellent survival rates and a chance for cure among stage I, II, and III hepatocellular carcinomas in patients with cirrhosis (24,25).

As leading successes in our country, the first early extubation protocol in the operating theater immediately after the operation was started with our transplant program in 2001 in both adult and pediatric patients (26,27). Today, the early extubation rate is approximately 90% for all. In addition, a living donor LT immediately after off-pump coronary artery bypass grafting was performed simultaneously in one session in 2010. Blood product transfusion-free operations can be performed with guidance from thrombelastography since 2004. Cell-saver return was only used at the beginning of the transplant program for only two cases.

With 23 years of experience, the availability of multidisciplinary doctors and specialists and our center to be under our university as one of the major education institutions of our country will assist us to move forward and carry out our mission for high-volume service as one of the significant LT centers in Turkey.

**Ethics Committee Approval:** N/A.

**Informed consent:** Written informed consent was obtained from the patients who participated in this study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept - M.Z., Z.K., I.T., S.A., F.O., E.T.; Design - M.Z., O.Ö., R.S., M.P., N.E., M.H., E.G., E.K., R.A.; Supervision - M.Z., G.E., U.A., Y.T., F.B., S.N., B.K.; Materials - M.Z., O.U., A.U., A.K., M.U.; Data Collection and/or Processing - M.Z., S.A., N.A., N.D.; Analysis and/or Interpretation - M.Z., S.U., T.Y. K.D.;

Literature Search - M.Z., N.Ö., F.G., F.T.; Writing Manuscript - M.Z., S.Ö., D.N., F.Y.; Critical Reviews - M.Z., M.T., A.N.

**Acknowledgements:** We would like to express our deep gratitude to Prof. Yaman Tokat, Assoc. Prof. Murat Kiliç, Prof. Ahmet Coker, Prof. Murat Sozbilen and Dr. Ata Bozoklar for their devoted works in the liver transplant programme of the Ege University during 1994 and 2015. Their precious efforts can not be denied in the success of this programme.

**Conflict of Interest:** The authors have no conflict of interest to declare.

**Financial Disclosure:** The authors declared that this study has received no financial support.

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