

## Donor Characteristics of Intestinal Graft in Turkey

### Türkiyedeki İntestinal Donor Greftlerinin Özellikleri

İsmail Sert<sup>®</sup>, Cem Tuğmen<sup>®</sup>, Maşallah Baran<sup>®</sup>, Sait Murat Dođan<sup>®</sup>, Emran Kuzey Avcı<sup>®</sup>, Eyüp Kebabçı<sup>®</sup>

Özgün Arařtırma  
Research Article

#### ABSTRACT

**Objective:** Intestinal transplantation is a challenging procedure and many factors effect the success of the intestinal transplantation. One of the important point is selection of the suitable donor. The characteristics of suitable donor for intestinal graft have not well defined yet. The purpose of the present study is to analysis the characteristics of intestinal graft in Turkey and discuss the results with those reported in the the literature.

**Method:** We retrospectively analyzed the donor characteristics (age, weight, cause of death, blood type, creatinine level, serum Na, etc.) of intestinal graft in Turkey. Also medical records of recipients like; age, weight, waiting time on the list, etc. were analyzed. The results were presented by percentages and numbers.

**Results:** Forty-two patients with intestinal failure were registered for intestinal transplantation since 2003. Thirty-two patients underwent intestinal transplantation. Five patients on waiting list died. The present study includes full data of 24 intestinal grafts and intestinal transplant recipients. Only 14 (58.3%) donors met The Organ Procurement and Transplantation Network (OPTN) criteria for intestinal transplantation. Sixteen (%66) donors were male. Median donor age and weight were 29 years and 75 kg, respectively. Median stay of the donor at Intensive care unit (ICU) was 3 days. Median donor/recipient body weight ratio was 1,41 (min: 0,84,max: 8,00). Ideal weight match was obtained for only 5 (20.8%) transplantations (1,1-0,76).

**Conclusion:** Intestinal transplantations are being performed in Turkey. Due to donor shortage, ideal donors are not available for use in Turkey. For pediatric donors, reduced size intestinal grafts might be used, but unfortunately recipient-donor weight match is still the most essential problem for improvement of intestinal transplantation procedures.

**Keywords:** Intestinal transplantation, intestinal graft, donor characteristics, reduced size graft, donor recipient body/weight ratio

#### Öz

**Amaç:** Bađırsak nakli başarısı birçok faktöre bađımlı olan oldukça zor bir prosedürdür. Bunlardan en önemlisi uygun donör seçimidir. Uygun intestinal greftin seçilmesini sağlayacak kriterler henüz tanımlanmamıştır. Bu çalışmada Türkiye'deki bađırsak greftlerinin donör özelliklerini analiz etmeyi ve sonuçları literatürle tartışmayı amaçladık.

**Yöntem:** Türkiyedeki intestinal greftlerin donör özellikleri (yaş, kilo, ölüm nedeni, kan grubu, kreatinin düzeyi, serum Na vb.) retrospektif olarak incelendi. Ayrıca alıcının yaş, kilo, listede bekleme süresi vb. gibi tıbbi kayıtları analiz edildi. Sonuçlar yüzde ve sayılarla sunuldu.

**Bulgular:** 2003 yılından itibaren bađırsak yetmezliđi nedeniyle intestinal transplantasyon yapılmak üzere 42 hasta kayıtlı idi. 32 hastaya bađırsak nakli yapıldı. Bekleme listesindeki beş hasta öldü. Bu çalışma 24 bađırsak nakli alıcısının ve bađırsak greftinin tam verilerini içermektedir. Bađırsak nakli için "The Organ Procurement and Transplantation Network (OPTN)" kriterlerine uyan sadece 14 bađıřçı (%58,3) bulundu. Donör cinsiyetlerinin 16'sı (%66) erkekti. Ortanca donör yaşı, kilosu sırasıyla 29 ve 75 kg idi. Vericinin median yoğun bakım ünitesi (YBÜ) kalış süresi 3 gün, ortalanca donör alıcı vücut ađırlıđı oranı 1.41 idi (min: 0,84, maks: 8,00). Ancak, transplantasyonların sadece 5'i (%20,8) ideal kilo uyumu ile yapıldı (1,1-0,76).

**Sonuç:** Türkiye'de intestinal transplantasyonlar yapılmaya devam edilmektedir. Donör azlıđı, Türkiye'de ideal olmayan donörlerin kullanılmasına yol açmaktadır. Çocuk hastalar için bađırsak greftlerinin küçültülerek kullanılabilir hale getirilmesine rađmen, alıcı - donör ađırlık uyumu hala bađırsak naklinin iyi bir şekilde gerçekleştirilmesindeki en önemli sorundur.

**Anahtar kelimeler:** İntestinal transplantasyon, bađırsak grefti, donör karakteristikleri, kısaltılmış greft, donör-alıcı vücut ađırlıđı oranı

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İsmail Sert

Sađlık Bilimleri Üniversitesi  
Tepecik Eđitim ve Arařtırma  
Hastanesi, Organ Nakli Kliniđi,  
İzmir - Türkiye

✉ drismailsertege@yahoo.com  
ORCID: 0000-0001-5190-9124

C. Tuğmen 0000-0002-2668-5197

E.K. Avcı 0000-0002-9221-4959

E. Kebabçı 0000-0001-8900-2325

Sađlık Bilimleri Üniversitesi  
Tepecik Eđitim ve  
Arařtırma Hastanesi,  
Organ Nakli Kliniđi,  
İzmir, Türkiye

M. Baran 0000-0003-3827-2039

Katip Çelebil Üniversitesi  
Tıp Fakóltesi,  
Pediatrik Gastroenteroloji  
Anabilim Dalı,  
İzmir, Türkiye

S.M. Dođan 0000-0001-8840-4365

İnönü Üniversitesi Tıp Fakóltesi,  
Karaciđer Nakil Enstitüsü,  
Malatya, Türkiye

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## INTRODUCTION

According to 2016 Annual data report of Scientific Registry of Transplant Recipients/Organ Procurement and Transplantation Network (SRTR/OPTN) 2016, the number of Intestinal transplantations is on a stable level during the last two decades <sup>(1)</sup>. Improvements in immunosuppressive treatment and immuno-monitoring and surgical technique have great impact on the decline of graft failure in the field of intestinal transplantation. Turkey had a great advancement in many solid organ transplantations like kidney, heart and liver transplantations. Unfortunately, many of these transplantations are performed using living donors. Although, the number of deceased donors has increased over the time in Turkey (2.7 pm in 2002-7.5 pm in 2013), its is still needed to be improved <sup>(2)</sup>.

Limited number of intestinal transplantations are performed in Turkey. The first intestinal transplantation was performed in 2003 and up to now only 32 intestinal transplantations have been realized in Turkey (2). Intestinal transplantation is a challenging procedure and many factors effect the success of the intestinal transplantation. Main reasons of intestinal graft failure may be summarized as: susceptibility of intestinal graft to ischemia-reperfusion injury and immunologic load of small bowel. One of the important factors for the success of intestinal transplantation is selection of suitable donors.

The characteristics of suitable donor for intestinal graft are not well defined yet. The purpose of the present study is to analysis the donor characteristics of intestinal grafts and discuss the results in line with the current literature. We decided to expand the donor pool without endangering the transplant success may help to improve the success of intestinal transplantations. The present study focuses on donor criteria of intestinal grafts from the perspective of a country with donor shortage.

## MATERIAL and METHODS

The data were collected from two intestinal transplant centers which are active in Turkey and reflect all intestinal transplant activities in Turkey. We retrospectively analyzed information retrieved from medical records of 24 donor, and recipient characteristics of intestinal grafts in Turkey. The data regarding the intestinal donor waiting list were also evaluated. Donor characteristics analyzed in this study were age, weight, blood group, cause of death, creatinine level, serum Na, liver enzymes as aspartate transaminase (AST) and alanine transaminase (ALT) levels, Intensive care unit (ICU) stay, vasopressor usage. and donor characteristics of intestinal grafts were compared with the current literature findings. Also the organ donor statistics from database of the Ministry of Health, Republic of Turkey were used to understand the current donation status in Turkey. The results were presented by percentages and numbers. This study was approved by the Local ethic committee of Tepecik training and Research Hospital, İzmir.

## RESULTS

Forty-two patients with intestinal failure were enrolled for intestinal transplantation since 2003. Intestinal transplantation has been performed for 32 patients (28 Tepecik training and Research Hospital, İzmir and 4 İnönü University, Liver Transplant Institute, Malatya) and 5 patients on waiting list for intestinal graft died. 2 patients have excluded from the waiting list because of the worse health condition for transplantation and 3 patients have still been on waiting list for intestinal transplantation. Medical records of 8 donors have not been reached. The present study includes all data related to 24 intestinal transplant recipients and intestinal grafts.

Seven intestinal recipients were in the pediatric age group. Forty-five percent of intestinal recipients

were male. Median recipient age and weight were 38 years (min 7 months, max 72 years) and 46 (min: 6 kg max: 83 kg) kg, respectively. Median waiting time on transplantation list was 27 days (min: 3 days, max: 365 days).

Only 14 (58.3%) donors met the OPTN criteria for intestinal transplantation. Except one, all pediatric intestinal transplantations were performed by donors who met OPTN criteria. All intestinal grafts were procured from brain- dead donors. All donors had negative virology for Human Immune deficiency virus (HIV), Hepatitis B surface antigen/Core antibody (HbsAg/Cab) and Hepatitis C virus Antibody (HCV Ab). Sixteen (%66.6) donors were male. Median donor age and weight were 29 years and 75 kg, respectively. Only one donor was in the pediatric age group (3 years old). Median ICU stay of the donor was 3 days (min: 1 day, max: 12 days). Median donor recipient body weight ratio was 1.41 (min: 0.84, max: 8.00). Ideal weight match (1.1-0.76) was obtained for only 20.8 percent of transplantations. Only 7 (29.2%) intestinal donors had identical blood groups. Median cold ischemia time (CIT) was 385 minutes (minimum: 250 min, maximum: 540 min). Six donors were not under vasopressor treatment at recovery and 2 donors were under treatment with two vasopressor drugs at recovery. Median creatinine level was 1.1 mg/dl (min: 0.4, max: 2.0 mg/dl). Median serum Na level was 145 mmol/L (min: 131mmol/L, max:

170mmol/L). Except one case, all donors had liver enzymes as AST and ALT < 500 UI/L. Donor characteristics of intestinal grafts were summarized in Table 1.

For all pediatric intestinal transplantation recipients except two cases, reduced -size intestinal grafts were used. In these two cases, one graft was removed during the operation and the other one was removed after 48 hours due to the graft thrombosis. Except one pediatric case who received jejunal graft, ileojejunum graft was used for all recipients.

Twenty-nine percent of the intestinal transplant recipients were hyper sensitized prior to transplantation. Graft and patient survival rates at 1 year for 7 pediatric recipients were identical (71%). For all 17 recipients, graft and patient survival rates were also the same (37.5%).

## DISCUSSION

Intestinal transplantation is performed in a limited number of transplant centers and many of these centers have low volume. Seventy-six percent of intestinal transplantations were performed in North America <sup>(3)</sup>. According to OPTN/SRTR 2016 annual data report, deceased organ donations were performed using 9971 donors in 2016 and 1.5% of these donor intestinal grafts were used for Intestinal transplantations <sup>(4)</sup>. The number of brain- dead patients in

**Table 1. Donor characteristics of intestinal grafts.**

	Median	Percentage	Numbers	Minimum-maximum
Donor Age	29 yrs			3 yrs-60 yrs
Donor sex		100%	n:24	
Female		33.3%	n:8	
Male		66.6%	n:16	
Donor weight	75 kg			15 kg-90 kg
ICU stay	3 days			1 day-12 days
Donor recipient body weight ratio	1.41			0.84-8.00
Percentage of ideal weight match		20.8%	n:5	
Creatinine level	1.1 mg/dl			0.4-2.0 mg/dl
Serum Na level	145 mmol/L			131-170 mmol/L
AST and ALT level>500		4.1%	n:1	
Vasopressor usage		33.3%	n:8	
Cold ischemia time	385 min			250-540 min
Blood group identical		29.2%	n:7	

ICU-Intensive care unit, yrs-years, kg-kilograms, AST- Aspartat transaminase, ALT- Alanin Transaminase

Turkey were 12670 between Jan 2011 and Jan 2018. During this period, organ donation rate was only 24 percent <sup>(2)</sup>. Unfortunately, most of the organ transplantations like liver and kidney are performed from living donors in Turkey. Only 23.8 % of solid organ transplantations were performed with grafts harvested from deceased donors in 2017. Donor pool is very limited. Current condition in Turkey is disadvantageous for procurement of suitable intestinal grafts. Present study revealed that, only fourteen donors (58.3%) met The USA Organ Procurement and Transplantation Network (OPTN) criteria for intestinal transplantation. It is one of the obstacles to improve the intestinal transplant activity in Turkey. Nowadays, intestinal transplantation from living donors is not common worldwide and reserved for selective patients. Living donor for intestinal graft maybe an option for especially pediatric age group in near future.

According to a comprehensive review including 3504 publications about intestinal transplantations; any of published studies had not specifically reported the donor characteristics <sup>(5)</sup>. The most mentioned donor criteria was donor age. Other factors were not dealt with constantly <sup>(5)</sup>. Analysis of these studies suggests that the donor age for intestinal graft should be 0-50 years. OPTN donor criteria for acceptance of intestinal graft also suggest the donor age to be under 50 years of age <sup>(6)</sup>. But when histopathological and molecular allograft injury characteristics and their relations with multi-organ donors were analyzed, graft histology did not differ in donors aged under and above 50 years <sup>(7)</sup>. In our study five donors were above 50 years old. We all know that extended criteria for donors are being used for liver and kidney transplantations, and improvement of the intestinal transplant results may lead to accept older donors for intestinal transplantation so as to expand the donor pool. The donor's age may not be a contraindication for intestinal donation alone.

Cold ischemia time (CIT) is an important and modifi-

able risk factor for structural graft quality. Graft quality has a strict correlation with the transplant outcomes <sup>(7)</sup>. Present study shows that CIT was kept under 9 hours for all intestinal grafts. According to OPTN donor criteria for acceptance of the intestinal graft, CIT should be shorter than 9 hours <sup>(6)</sup>. But there are also some reports with good results for CITs shorter than 12 hours <sup>(5)</sup>. In a study that evaluated the histopathologic injury features in multi-organ donors, there was no histologic difference among grafts harvested from donors under CITs below and above 9 hours <sup>(7)</sup>. But critical threshold for CIT could not be confirmed <sup>(7)</sup>. Current approach is to keep the CIT under 9 hours but in near future technological developments, like the machine perfusion techniques in intestinal grafts, may prolong acceptable CIT.

Seventy-two percent of 2147 transplant patients were at home prior to primary intestinal transplantation, between 2001 and 2011, according to registry data <sup>(3)</sup>. In South America and Asia, proportionally sicker patients had undergone intestinal transplantation <sup>(3)</sup>. In our series, all patients were hospitalized prior to transplantation. So, patients may be more vulnerable to the resistant infections. This condition also stems from the lack of a well-established home parenteral nutrition service in Turkey.

Primary abdominal closure is a challenging procedure especially for pediatric patients, because of the loss of abdominal domain and intestinal edema after reperfusion. Discrepancy of donor-to-recipient body weight ratio may cause abdominal compartment syndrome and ischemia-necrosis of the graft <sup>(8)</sup>. Ideal donor-to-recipient body weight ratio is defined as 1.1 and 0.76 <sup>(9)</sup>. Donor-recipient size mismatch leads to rejection of many organs and diminishes the donor pool for intestinal transplantation. One of the solutions to overcome the size mismatch is to use the reduced-size grafts. Our common preference is also to use the reduced-size intestinal grafts for pediatric patients. This technique helps us to use intestinal grafts of the adults for pediatric population, as

well. Its safety and feasibility have been previously shown in many reports <sup>(10)</sup>. Other options to overcome the abdominal closure problem may be summarized as abdominal reconstruction, use of an expander, absorbable mesh, and abdominal wall transplantation. In many cases the combination of these options is needed.

Intestinal transplantation activity is in progress, in Turkey. Due to donor shortage, ideal donors are not available for use as sources of intestinal graft in Turkey. For pediatric donors, reduced-size intestinal grafts might be used, but unfortunately recipient-donor weight mismatch is still the most essential problem for improvement of intestinal transplantation activity.

#### **Study Limitations:**

Present study includes small number of donor data, so statistical analysis could not be performed. Study results were compared with the current literature results. But this study results are important because it yields a small volume center data of a center in a developing country.

**Ethics Committee Approval:** The approval of Health Sciences University İzmir Tepecik Health Application Research Center Non-Interventional Ethics Committee was obtained (2018/13-7).

**Conflict of Interest:** All authors of this manuscript declare that there is no conflict of interest.

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## REFERENCES

1. Smith JM, Weaver T, Skeans MA, Horslen SP, Harper AM, Snyder JJ. OPTN/SRTR 2016 Annual report: Intestine. *Am J Transplant*. 2018;18(1):254-90. [\[CrossRef\]](#)
2. <https://organ.saglik.gov.tr/OTR/70Istatistik/OrganNakillistikKamusal.aspx>
3. Grant D, Abu-Elmagd K, Mazariegos G, et al. Intestinal transplant registry report: global activity and trends. *Am J Transplant*. 2015;15(1):210-9. [\[CrossRef\]](#)
4. Israni AK, Zaun D, Rosandale JD, Schaffhausen C, Snyder JJ, Kasiske BL. OPTN/SRTR 2016 Annual data report: Deceased organ donation. *Am J Transplant*. 2018;18(1):434-63. [\[CrossRef\]](#)
5. Fischer-Frohlich CL, Konigsrainer A, Scahaffer R, et al. Organ Donation: When should we consider intestinal donation. *Transpl Int*. 2012;25(12):1229-40. [\[CrossRef\]](#)
6. Mazariegos GV, Steffick DE, Horslen S, et al. Intestinal transplantation in the United States, 1999-2008. *Am J Transplant*. 2010;10(4):1020-34. [\[CrossRef\]](#)
7. Roskott AM, van Haaften WT, Leuvenink HG, et al. Histopathologic and molecular evaluation of the organ procurement and transplantation network selection criteria for intestinal graft donation. *J Surg Res*. 2014;189(1):143-51. [\[CrossRef\]](#)
8. Alexandrides IJ, Liu P, Marshall DM, Nery JR, Tzakis AG, Thaller SR. Abdominal wall closure after intestinal transplantation. *Plast Reconstr Surg*. 2000;106:805-12. [\[CrossRef\]](#)
9. Fishbein TM, Bodian CA, Miller CM. National sharing of cadaveric isolated intestinal allografts for human transplantation: a feasibility study. *Transplantation*. 2000;69:859-63. [\[CrossRef\]](#)
10. Lauro A, Vaidya A. Role of "Reduced size" liver/bowel grafts in the abdominal wall transplantation era. *World J Gastrointest Surg*. 2017;9(9):186-92. [\[CrossRef\]](#)