



Original Research

A Novel Technique for Cadaveric Organ Procurement: Exposure with Internal Transverse Fascia and Vertical Skin Incision

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Abstract

Objectives: To describe a technique for retrieval of abdominal organs from a cadaveric donor and to report the outcomes of 59 cases at a single center.

Methods: We retrospectively analyzed data from 59 cadaveric organ retrieval operations between 2016 and 2021. The internal transverse fascia incision technique was used in all cases.

Results: Of the 59 patients 37 was male and 22 was female. Median intensive care unit stay was 10 days. The technique provided good exposure for abdominal closure, allowing for the retrieval of the liver, kidneys, and spleen. Aesthetic results and respect for the donor's body were also achieved.

Conclusion: Internal transverse fascia and vertical skin incision is a feasible and efficient method for abdominal organ procurement in cadaveric donors. Further studies are needed to validate and compare technique to other established methods.

Keywords: cadaveric, donor, technique, internal transverse fascia incision, procurement, transplantation

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Organ transplantation is a definitive and inevitable solution for end-stage disease, fulminant liver failure or end-stage kidney disease. There is an organ shortage for patients suffering from end-stage diseases. Cadaveric and living donors are two primary sources of organs for transplantation. Cadaveric donors are deceased individuals whose organs are procured after brain or circulatory death confirmation. On the other hand, living donors are healthy individuals who voluntarily donate one of their organs, typically a kidney or a part of their liver, to a recipient in need.^[1]

While living donor transplantation has the advantage of better graft survival rates and the possibility of pre-emptive transplantation, it is limited by the availability of suitable donors and the potential risks to the donor's health. Cadaveric transplantation allows for a more excellent pool of organs. How-

ever the quality of organs may be affected by various factors such as cause of death, donor age, and comorbidities.^[1,2]

Xenotransplantation, which involves the transplantation of organs, tissues, or cells from one species to another, has emerged as a potential solution to address the shortage of organs for transplantation. However, despite promising advancements in the field, xenotransplantation is not yet widely applied due to unresolved issues such as immunological barriers, ethical concerns, and the potential for transmission of zoonotic diseases.^[3,4]

A critical distinction between living and deceased donors lies in the incision method employed during the organ harvesting process. For obtaining organs from deceased donors, the thoracoabdominal cavities are typically opened using a midline incision that stretches from the supraster-

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nal notch to the symphysis pubis. This procedure is known as the thoracoabdominal approach or the standard organ procurement technique (SOPT).^[5] If intrathoracic organ extraction is not required, intraabdominal organs can be procured through abdominal incisions without requiring sternotomy. This method, called the modified standard organ procurement technique (MSOPT).

In this paper, we would like to present a novel MSOPT technique in cadaveric donors. This technique is favored for harvesting cadaveric organs and helps to ensure good exposure.

Methods

Patient Population and Data Collection

We retrospectively reviewed medical records from 121 cadaveric donors. 11 of them were allowed to be donor due to infection, sepsis and malignancy. 14 of the organ procurement operations performed by another transplantation team. Of 96 patients organ procurement performed by our team but 37 of them have some missing data and our described technique were not performed. Ultimately, the study enrolled 59 eligible patients between 2016 and 2021. (Fig. 1) An experienced surgical team performed all procurement procedures. Demographic and clinical

characteristics, including sex, age, comorbidities, cause of death, cardiac arrest, cardiopulmonary resuscitation (CPR) duration, intensive care unit (ICU) stay duration, inotropic treatment, nationality, were collected from patient records. Laboratory parameters were also collected, including hemoglobin, white blood cell count, platelet count, sodium, potassium, creatinine, aspartate transaminase (AST), alanine transaminase (ALT), total and direct bilirubin, international normalised ratio (INR), and C-reactive protein (CRP) levels were also collected. The study was approved by University of Health Sciences- Antalya Education and Research Hospital's ethical committee with 188/2023 registration number.

Surgical Procedure

The organ retrieval procedure began with the detecting brain death, followed by meticulous donor care and family consent. Under general anesthesia, a midline incision was made from the xiphoid process to the suprapubic region. In our novel technique we make an incision to subcutaneous tissue, muscle, fascia, and parietal peritoneum using suitable energy devices lateral inner umbilicus level to Toldt's fascia bilaterally, while preserving the skin. The skin of the abdomen was temporarily sutured to the linea alba using

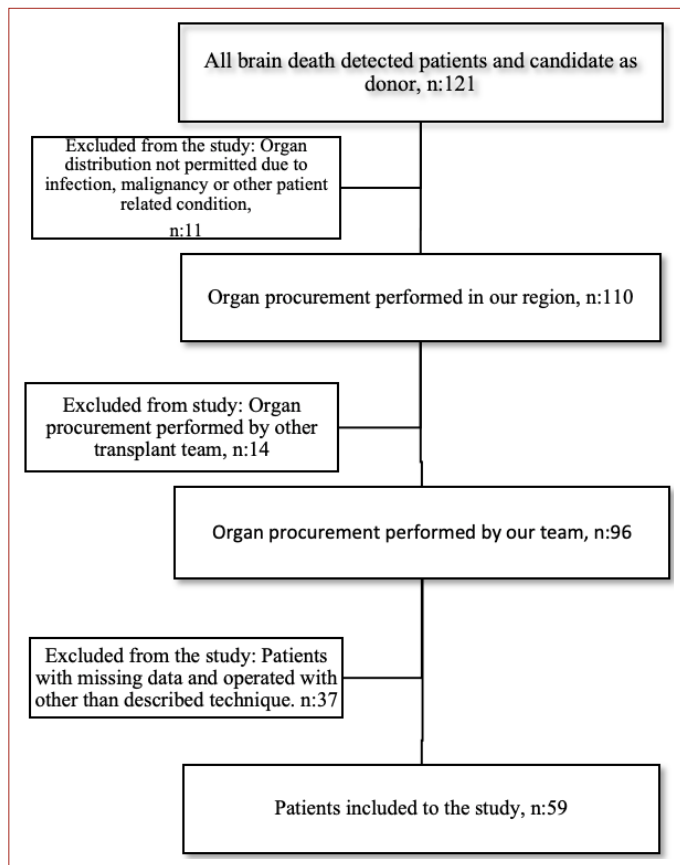


Figure 1. Flowchart of the patient selection enrolled in current study.

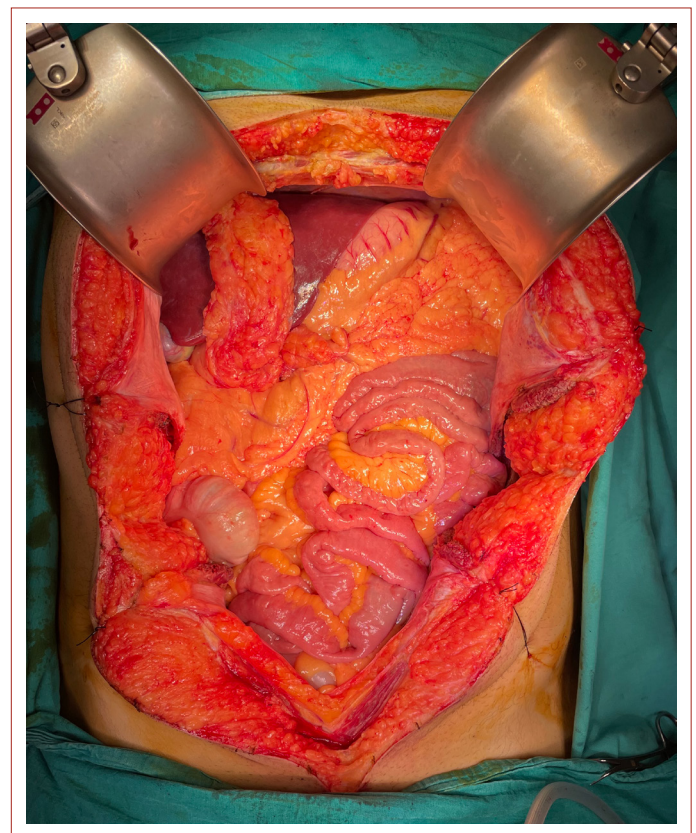


Figure 2. General appearance of the abdominal cavity after Internal Transverse Fascia and Vertical Skin Incision.

No. 1 silk suture for improved exposure (Fig. 2).

This abdominal opening allows us a great view of abdominal cavity and organs. Utilizing the Cattell and Braasch maneuver, the inferior vena cava was suspended superiorly to the left renal vein. The inferior mesenteric vein was secured, and a cannula was introduced. The distal abdominal aorta was exposed and suspended near the iliac bifurcation, allowing for the placement of an additional cannula. Both hemidiaphragms were incised anteriorly in a crescent-like shape close to the costochondral junction, providing access to the thoracic cavity. The inferior vena cava's opening in the right atrium was identified within the pericardial sac.

A cross-clamp was applied to the supraceliac abdominal aorta, and the right atrium was opened to prevent potential liver overdistention. All supportive medicine were discontinued at this point. The inferior vena cava was opened superior to the hepatic vein, and 3 L ringer lactate and 1 L of the University of Wisconsin solution were infused through the distal abdominal aortic cannula. Crushed ice was added to the abdominal cavity to maintain a cold environment.

An additional 2 L ringer lactate and 500 ml of the University of Wisconsin solution were introduced through the inferior mesenteric vein cannula to perfuse the portal vein. Upon completion of the perfusion process, the visceral organs were meticulously removed using en bloc dissection. Subsequently, the vascular pedicles of the organs were dissected on the back table for further analysis and preparation.

Following organ retrieval, the abdominal incision was closed anatomically. The lateral and midline fascia were approximated using No. 1 PDS or Prolene suture, and the skin was sutured subcutaneously with 3/0 Prolene or rapid Vicryl (Fig. 3).

Results

Of the 96 cadaveric donors we have the data of 59 patients and 37 (63%) were male, and 22 (37%) were female. The median age was 51 years (IQR, year: 38-65). Cardiac arrest occurred in 16 (27%) cases, with a median CPR duration of 10 minutes (IQR, minute: 5-15). The median ICU stay duration was 4 days (IQR, day: 2-7). Nationality distribution showed 51 (86%) were citizens and 8 (14%) were foreign. Blood group A is most frequently observed one (Table 1). The leading cause of brain death was listed and the most common cause of death was cerebrovascular accident (75%), followed by multiple trauma (6%) and intracranial lesions (8%) (Table 2). The various laboratory data of the patients were given in Table 3.



Figure 3. Appearance after organ procurement.

Discussion

Since Starzl first described the multiorgan procurement procedure the technique has been modified^[6,7] SOPT and MSOPT^[1] are examples of the described techniques. Here we modified the abdominal incision of these both methods. The extensive exposure and comfortably preparation and dissection of donated organs are important issue for postoperative results after implantation. The inner transverse incision technique presented in this study offers several advantages over traditional methods of organ retrieval from cadaveric donors. By providing an extensive working area, easy implementation, and a respectful approach to the donor's body, this technique may contribute to improv-

Table 1. Demographic data of all patients, n:59

Sex, Male/Female, n (%)	37 (63)/22 (37)
Age, Median (IQR)	51 (38-65)
Blood Group (n)	
A Rh+/-	23/1
B Rh+/-	15/3
O Rh+/-	12/1
AB Rh+/-	3/1
Nationality; Citizen/Foreign, n (%)	51 (86)/8 (14)
ICU stay, days, Median (IQR)	4 (2-7)
CPR, min, Median (IQR)	10 (5-15)

IQR: Interquartile Range; ICU: intensive care unit; CPR: cardiopulmonary resuscitation.

Table 2. Causes of brain death n:59

	n	%
Cerebrovascular accident	44	75
Multiple trauma	4	6
Intracranial lesion	5	8
Cardiac arrest	2	3
Methil alcohol intoxication	1	2
Multi organ dysfunciton	1	2
Status epilepticus	1	2
Drowning in water	1	2

ing the organ retrieval process.

One of the main benefits of the inner transverse incision technique is the ability to reduce the risk of organ damage during the retrieval process. As organ quality is crucial for the success of transplantation, any technique that minimizes damage to the graft holds significant potential. By offering a wider working area and reducing the need for additional incisions, this technique allows the surgical team to work more comfortably and efficiently. This point may result in shorter operative times, which has been shown to impact organ quality and transplantation outcomes positively. In the existing literature, two predominant dissection methodologies are delineated.^[8] In our study, we consistently employ cold dissection techniques to mitigate excessive hemorrhaging and subsequently reduce the overall duration of the surgical procedure.

Another critical aspect of the inner transverse incision technique is its respectful approach towards the donor's body. In many cultures, how a deceased person's body is treated carries significant emotional and spiritual implications for the bereaved family. By preserving the skin and ensuring a satisfactory cosmetic outcome, this technique demonstrates respect for the donor's body and aligns with the wishes of the relatives. This, in turn, may foster a more positive attitude towards organ donation, potentially increasing the number of donors and helping to address the organ shortage crisis.

Despite the encouraging results of this study, some limitations need to be acknowledged. As previously mentioned, the study's single-center and retrospective nature may limit the findings' generalizability. Moreover, a direct comparison with other established techniques would provide a better understanding of the advantages and potential drawbacks of the inner transverse incision technique. Future research could also explore the use of this technique in various clinical settings and its potential impact on donor family satisfaction and overall organ transplantation outcomes.

Table 3. Laboratory parameters of donors

Hemoglobin, Mean±SD (SEM)	11.2±2.17 (0.28)
White Blood Cell x 10 ³ , Mean±SD (SEM)	19.45±11.3 (1.49)
Platelets x 10 ³ , Mean±SD (SEM)	212±110.5 (14.7)
Sodium, Mean±SD (SEM)	153.8±13.8(1.8)
Potassium, Mean±SD (SEM)	4.37±3.61 (0.47)
Creatinin, Mean±SD (SEM)	1.61±1.78 (0.23)
AST, Mean±SD (SEM)	84.4±182(23.9)
ALT, Mean±SD (SEM)	100±407 (53.5)
Total Billirubin, Mean±SD (SEM)	1.05±1.22 (0.16)
Direct Billirubin, Mean±SD (SEM)	0.53±0.73 (0.17)
INR, Mean±SD (SEM)	1.29±0.48 (0.06)
CRP, Mean±SD (SEM)	128±124 (17.8)

AST: aspartate transaminase; ALT: alanine transaminase; INR: international normalised ratio; CRP: C reactive protein; SEM: standart error of mean; SD: standart deviation.

In summary, the inner transverse incision technique offers a promising alternative to traditional methods of organ retrieval in cadaveric donors. By providing a wide working area, easy implementation, and a respectful approach to the donor's body, this technique can potential to improve the efficiency and outcomes of the organ retrieval process. Further studies are needed to validate these findings and explore the potential applications of this technique in different clinical contexts.

Disclosures

Ethics Committee Approval: The study was approved by University of Health Sciences- Antalya Education and Research Hospital's ethical committee with 188/2023 registration number.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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